

**A SUSTAINABILITY-DRIVEN E-GOVERNMENT MATURITY MODEL
(SDEGM) FROM THE PERSPECTIVES OF DEVELOPING COUNTRIES**

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**A SUSTAINABILITY-DRIVEN E-GOVERNMENT MATURITY MODEL
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Abstract

E-government has become an essential means for delivering government services in effective, efficient and transparent way. While the implementation and adoption of the e-government services have been rapidly expanding, the governments of the developing countries are facing enormous challenge to make them sustainable. The sustainable e-government services require high level of agility and elasticity while keeping the government expenses within the budget. Traditional e-government projects have become more expensive and less affordable for the countries those have tight budget and resource constraints they require more time and more money to deploy. Beside this, sustainability of the e-government has been affected by the different factors, i.e. technology centric e-government design, human resources, access to the information communication technology and digital divide. Along with these factors, e-government maturity model has been identified in the existing literature as a major contributor of the e-government project failure. Studies shows that the development of the e-government projects in the developing countries does not align with the stages defined by the existing e-government maturity models. To verify the findings of the previous studies, we have critically reviewed the existing maturity models for their impact and contribution on sustainability of the e-government projects and made several observations, i.e., lack of detailed activities, technology-centric nature, emphasis on implementation, and lack of an adoption perspective. The review showed that it is imperative to develop a new maturity model in order to deliver sustainable e-government services in the context of the developing countries.

Therefore, this research contributes towards proposing a sustainability-driven e-government maturity model (SDEGM) to design and deliver sustainable e-government services. The SDEGM adopts holistic approach of e-government sustainability that gives equal importance to the implementation and adoption dimension of the e-government services. Five determinants are considered, i.e., a detailed process, streamlined services, agile accessibility, use of state-of-the-art technology, and trust and awareness for a sustainable e-government services from the perspective of developing countries. To guide the government in e-government implementation process, SDEGM introduces list of concepts, and assimilation process. The concepts supports government to define different requirements, i.e. goal, approach, services, stakeholders and risks. Similarly the assimilation process serves as a detailed strategic guide to implement SDEGM.

The SDEGM is evaluated through real e-government project in Nepal by following empirical investigation that adopts methodological triangulation. Since the sustainability has been defined from the different perspectives, i.e. implementation and adoption, the methodology employed to evaluate each dimension also differs. The triangulation includes, case-study, expert opinion and survey methods. Implementation dimension of the SDEGM has been evaluated by adopting the case-study method that verifies whether the sustainability goal of SDEGM, i.e. cost, time, usability and adoptability have been met or not. Similarly, survey method has been adopted to evaluate the sustainability of the SDEGM from the adoption or user perspectives that evaluates if the government services are aligned with the user requirements. Finally, the expert opinion is used to generalize the findings and validating the model. The empirical research findings confirm that the proposed model is able to deliver sustainable e-government services.

Declaration

I hereby declare that the thesis entitled “**A sustainability-driven e-government maturity model (SDEGM) from the perspectives of developing countries**” submitted for the partial fulfilment of the requirements for the degree of Doctor of Philosophy, contains the findings and conclusions from implementing my own ideas which has not been used/submitted in whole or part for the purpose of obtaining any degree from any university previously.

I further declare that to the best of my knowledge and understanding, all third-party material used in the thesis have been cited and indexed appropriately.

Pusp Raj Joshi

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Table of contents

List of publication.....	1
List of Figure.....	2
List of Tables	3
List of Abbreviations	4
Acknowledgement	6
<i>Introduction and background of the research</i>	7
1.1. Introduction	8
1.2. Background	9
1.3. Context of the study	11
1.4. Problem domain.....	12
• Lack of citizen-centric e-government approach	12
• Lack of streamlined e-government services	12
1.5. Research questions	13
1.6. Research aim and objectives	13
1.7. Significance of the study	14
Figure 1.1: SDEGM development process.....	15
1.8. Structure of the thesis	16
1.9. Summary	19
<i>Background and literature review</i>	21
2.1. Introduction	22
i. Government to Government (G2G).....	23
ii. Government to Business (G2B).....	24
iii. Government to Citizen.....	24
iv. Government to employee (G2E)	25
2.2. E-government design and implementation approaches	29
2.3. Electronic government maturity model and its impact on sustainable e-government services.....	32
2.4. The impact of digital divide on e-government sustainability	40
2.5. Cloud computing for sustainable e-government service	44
2.6. Challenges in cloud based electronic government	46
i. Privacy and security	47
ii. Availability.....	48
iii. Reliability:.....	48
iv. Information blocked.....	49
v. Interoperability	49
2.7. Chapter Summary	50

<i>Background of sustainability-driven E-government maturity model</i>	51
3.1. Introduction	52
3.2. Determinants of the Sustainability-driven e-government maturity model.....	52
3.2.1. Implementation Determinants	53
3.2.2. Adoption Determinants	54
3.3. An overview of the proposed approach	56
3.3.1. Implementation Perspectives	57
Stage 1: Basic Services	57
Stage 2: Streamlined Services	58
Stage 3: Transaction Services.....	60
Stage 4: Automated Services (One-Stop Shops and E-Democracy)	61
3.3.2. Adoption Perspectives	61
Stage 1: Awareness and trust	62
Stage 2: Know-how	62
Stage 3: Agile accessibility	62
Stage 4: Involve	63
3.4. Chapter Summary	63
<i>Sustainability-driven e-government model Implementation approach</i>	64
4. Introduction	65
4.1. Framing the concepts.....	65
4.2. Conceptual model	68
4.3. Assimilation process	70
4.3.1. Stage 1: initiate	71
4.3.2. Stage 2: Assess	79
4.3.3. Stage 3: E-government service implementation and migration	86
4.3.4. Stage 4: Evaluate	88
4.4. Summary	90
<i>Research design and methodology</i>	92
5.1. Research methodology overview	93
5.2. Research approach.....	93
i. Qualitative approach.....	94
ii. Quantitative approach	94
iii. Mixed method research approach.....	95
5.3. Research method used in this study	96
5.4. Research design	97
5.5. Research strategy.....	99
5.6. Methodological triangulation	100

5.7.	Action research	100
5.8.	Case-study	102
5.9.	Expert opinion.....	104
5.10.	Survey.....	105
5.11.	Data analysis	106
5.12.	Validity of the study results	106
5.13.	Chapter Summary	108
	<i>Empirical evaluation</i>	109
6.1.	Introduction	110
6.2.	First Stage: Case study	111
	Case Study context.....	111
	E-government service assessment.....	112
	Existing e-government maturity model	113
6.2.1.	Case study 1: Evaluation of the maturity model stages.....	115
6.2.2.	Study objectives	115
6.2.3.	Study plan and team	116
6.2.4.	Implementation process	117
6.2.5.	Case study Observations.....	122
6.3.	Case study context 2: Evaluation of model assimilation approach	125
6.3.1.	Study objective.....	125
6.3.2.	Study plan	126
6.3.3.	Case-study team.....	127
6.3.4.	Assimilation process.....	128
	Phase 1: initialize e-government vision	128
	Stage 2: Initialise technology to support the e-government approach.....	132
	Stage 3: E-government service implementation and migration	139
	Stage 4: Monitor and evaluation	142
6.4.	Survey.....	144
6.4.1.	Survey construct	145
6.4.2.	Sample selection	145
6.4.3.	Sample size.....	145
6.4.4.	Pilot testing	146
6.4.5.	Survey Context	146
6.4.6.	Survey Findings	147
	Subjective data analysis	147
	Descriptive statistic.....	150
6.4.7.	Reliability of the construct.....	152

6.4.8.	Regression analysis	153
6.5.	Expert opinion.....	154
6.5.2.	Study construct	156
6.5.3.	Expert opinion findings	157
i.	Usability of the proposed approach	157
ii.	Government services efficiency.....	158
iii.	E-government implementation cost	159
iv.	E-government implementation approach	160
v.	Integrated e-government services.....	160
6.6.	Summary	161
	<i>Discussion</i>	163
7.1.	Background	164
7.2.	Discussion about case study findings.....	164
•	Sustainability from technical perspective:.....	165
•	Organisational Sustainability:	165
7.3.	Discussion on survey findings	166
7.4.	Discussion on the expert opinion findings.....	167
7.5.	Validation of the determinants.....	167
7.6.	Summary	172
	<i>Conclusions, discussions and further work</i>	173
8.1.	Research Outline.....	174
	Stage 1: Background theory.....	175
	Stage 2: Focal theory.....	175
	Stage 3: Data theory	176
	Stage 4: Contribution	176
8.2.	Responding research questions, aim and objectives.....	177
8.3.	Research contribution.....	179
8.4.	Research limitations and Recommendations	180
8.5.	Further work	181
8.6.	Summary	181
	References	183
	Appendices.....	204

List of publication

- I. Joshi, P. R., Islam, S., & Islam, S. (2017). A Framework for Cloud Based E-Government from the Perspective of Developing Countries. *Future Internet*, 9(4), 80
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List of Figure

Figure 1.1: SDEGM and its components

Figure 1.2: Thesis outline

Figure 2.1: Types of E-Government

Figure 2.2: UK government portal (Source: Gov.uk)

Figure 2.3: USA government portal (Source: USA.Gov)

Figure 2.4: Korea government portal (Source: Korea.net)

Figure 2.5: Sri Lanka government portal (Source: Gov.lk)

Figure 2.6: Online sophistication and e-government uses by individuals

Figure 2.7: Layne & Lee four maturity model

Figure 2.8: Digital divide among the developed and developing countries

Figure 3.1: Determinants of the sustainability-driven e-government maturity model (SDEGM)

Figure 3.2: E-government maturity model for sustainable e-government services.

Figure 3.3: Integration of e-government system for streamlined e-government services.

Figure 4.1: Conceptual Model

Figure 4.2: Assimilation process

Figure 4.3: G2G e-government approach for streamlined services

Figure 4.4: service streamlining through IPaaS for sustainability

Figure 4.5: Delivery channels for accessing e-government services

Figure 4.6: Integrated approach for service streamlining

Figure 4.7. Cost benefit analysis

Figure 4.8: Cloud service model adoption decision tree

Figure 4.9: Performance evaluation process

Figure 5.1: The research design

Figure 5.2: Methodological triangulation for evaluation

Figure 5.3: Evaluation approach for proposed model from implementation perspectives

Figure 6.1: Model Evaluation process

Figure 6.2: Case study Plan

Figure 6.3: Comparison of time to implement e-government service

Figure 6.4: Case study Plan

Figure 6.5: Selection of cloud deployment model

Figure 6.6: Expert opinion process using Delphi

Figure 7.1: Revised determinants of the sustainable e-government service design

List of Tables

- Table 1.1:** Technology (service) centric Vs User centric design
- Table 1.2:** E-government maturity models based on the number of stages
- Table 1.3:** Extent of electronic service (e-service) delivery stages in various countries
- Table 4.1:** Streamlined e-government service through integration
- Table 4.2:** Cloud readiness assessment.
- Table 4.3:** Cloud computing deployment model selection factors
- Table 5.1:** Characteristics of the different research approach
- Table 5.3:** Data sources used in the research
- Table 6.1:** E-government services offered by Nepal government (NITC, 2017)
- Table 6.2:** Comparison of Nepal e-government with Layne & Lee's maturity model
- Table 6.3:** Delivery channels for the e-government services
- Table 6.4:** Feasibility study finding
- Table 6.5:** Department IT spending for e-government (in Nepali currency)
- Table 6.6:** Cost estimation of cloud service adoption
- Table 6.7:** Cloud deployment model selection score
- Table 6.8:** Risk assessment for cloud service adoption
- Table 6.9:** Clause included in service level agreement (SLA)
- Table 6.10:** Survey respondent statistics.
- Table 6.11:** Participants using ICT tools and having awareness.
- Table 6.12:** Variation in the adoption of e-government services.
- Table 6.13:** Response rate of survey participant
- Table 6.14:** e-government adoption pattern among different groups of people
- Table 6.15:** Person's chi-square test
- Table 6.16:** Instrument Reliability test using Cronbach's coefficient alpha
- Table 6.17:** Initial regression analysis
- Table 6.18:** Further regression analysis.

List of Abbreviations

Acronyms	Terms
E-gov	Electronic Government
E-Services	Electronic Services
INGO	International Non-Government Organisation
ICT	Information Communication Technology
G2G	Government To Government
G2C	Government To Citizen
G2B	Government To Business
G2E	Government To Employee
ATM	Automated Teller Machine
IT	Information Technology
CSP	Cloud Service Provider
MSA	Master Service Agreement
SLA	Service Level Agreement
AaaS	Application As A Service
PaaS	Platform As A Service
IaaS	Infrastructure As A Service
IpaaS	Integration Platform As A Service
IS	Information System
UN	United Nation
OECD	Organisation for Economic Co-Operation And Development
CPU	Central Processing Unit
TFL	Transport For London
USA	United states of America
UK	United Kingdom
NSA	National Security Agency
EC2	Elastic Compute Cloud
NITC	National Information Technology Centre
GIDC	Government Integrated Data Centre
OCR	Office of Company Registrar
VAT	Value Added Tax
PAN	Permanent Account Number
TDS	Tax Deducted at Source
e-BPS	Electronic Building Permit system
MOGA	Minister of General Administration

BPR	Business Process Redesign
PSC	Public Service Commission
KIPA	Korea IT Industry Promotion Agency
LAN	Local Area Network
WAN	Wide Area Network
ENISA	European Union Agency for Network and Information Security
APM	Application Performance Management
B.S	Bikram Sambat (Nepali year)
CDMA	Code Division Multiple Access
NeGIF	Nepal E-Government Interoperability Framework
EA	Enterprise Architecture
VPS	Virtual private server
GB	Giga Byte
TB	Tera Byte
EGDI	Electronic Government Development Index

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A summary of proposed research is presented in this chapter. The chapter contains an introduction of the research area and background, followed by problem domain, research aim and objective, context of the study, significant of the study and research design. To sum up the overall idea of the purposed research, a summary is presented at the end of this chapter.

1.1.Introduction

The phenomenon of e-government in the past couple of decade has taken the government service delivery approach to the next level. The advancement in technology has brought such a dramatic change that almost every government service could be delivered and acquired electronically. This trend has attracted many developing and less developed countries to implement e-government to enhance the government service delivery approach that would save government resources. However, e-government projects in developing countries suffer a poor success rate in that only 30 percent of e-government projects manage to sustain the actual delivery stage (Heekss, 2003, Anthopoulos et al., 2016). Among the various reasons of poor sustainability rate of the e-government services, the lack of adequate ICT infrastructure, payment gateway and e-government service delivery channels are some of the major issues (Dada, 2006, Lessa et al., 2016, Napitupulu & Sensuse, 2014). Beside this, the lack of attention to e-government adoption while designing and implementing e-government projects is one of the key contributors in e-government project failure. Lessa et al. (2014) found that governments put a high emphasis on the sophistication of the technology for e-government implementation while the adoption part is often overlooked, creating a gap in the implemented service and user strength to adopt those services. A digital divide among the people, poorly offered e-government services, and availability and access to the technology results in the poor adoption of the e-government services. Syamsuddin (2011) found that the government approach for initiating an e-government in the government-to-citizen (G2C) dimension is problematic for developing countries especially when e-government systems are not integrated. Farzali et al. (2012) also identified that the lack of streamlined e-government services makes the offered services incomplete and discourages users from getting involved.

Although occurrences of these issues in the developing countries are inevitable, if appropriate measures are taken when designing e-government projects, governments would be able to achieve wider participation from stakeholders in e-government service uptake. Therefore, this research contributes towards developing a sustainable driven e-government model, which would support the governments in the developing countries to design and implement sustainable e-government services. The purpose of this chapter is to discuss the significant of the research being undertaken. While doing so, the chapter presents a brief background on the subject domain that provides an understanding on the gap in the knowledge, the problem statements, research aim and

objective along with the research motivation and research questions. The chapter also provides an outline of the thesis chapters.

1.2. Background

Scheepers et al., (2012) Found that the electronic government projects in developing countries are not considered as successful as their counterpart in developed countries. Heekss (2003) has done substantial research in e-government domain and found that 35% of the electronic government projects have been failed completely (e-government was not implemented or was implemented but immediately abandoned) in the developing countries, and 50% are partially failed (major goals were not attained and/or there were undesirable outcomes). Since the fact has come to the light many studies have concentrated to reach to the bottom to investigate the failure factors. United Nation (2013) found lack of electronic government readiness (e-readiness) is one of the fundamental factor causing the failure of the e-government in developing countries. E-government readiness refers to the information communication technology (ICT) infrastructure, e-literacy, and stakeholder's access to the information communication tools such as computer and internet (Dada 2006, Koh et al., 2008, Alghamdi et al., 2011). While e-readiness has been presented as a primary issue in successful electronic government projects implementation, Ndou (2004) argues that the large and complex nature of the project that demand substantial amount of budget, technological support and human resources to manage and operate these projects are limiting the efforts of the developing countries shifting towards electronic government. Although technology remains as a core factor of success and failure of electronic government (Ebrahim and Irani 2005), organizational and design issues have been given equally importance. Syamsuddin (2011) says despite having sound infrastructure in place many electronic government projects failed to achieve their goal because of design reality gap. Design reality gap has been mentioned by Norman and Draper (1986) in their book "User Centred system design." They described the design reality gap as a gulf between the current physical system and the goal, which must be minimized or bridged by the designer to achieve the goals.

Heeks (2003) has defined design reality gap in the context of electronic government projects. In his words "the current realities and situation and the proposed model or conception and assumptions built into the electronic project's design is design reality gap." The larger the gap the greater the risk of the e-government failure. A problem that

often arises in developing countries is a mismatch between the electronic government readiness and proposed systems design. Heeks has found that the lack of understanding among the software designer and the policymaker has contributed to create this gap. Whether it is technological, or it is design issue, electronic government projects in developing countries are at high risk (Shareef et al., 2011). This is a disturbing fact says Dada (2006), especially as developing countries have a limited number of resources at their disposal and cannot afford to wastefully spend of large amounts of money typical on such projects.

These issues have built pressure upon the governments to take a step forward to look for a sustainable electronic government solution which is cost effective yet more efficient and competitive to the traditional electronic government. While taking initiative to identify comprehensive solution to the traditional electronic government, developed countries have adopted cloud computing to host electronic government (Foster et al., 2008). Cloud computing refers to an emerging model of computing where machines in large data centres can be dynamically provisioned, configured, and reconfigured to deliver services in a scalable manner (Armbrust et al, 2010, Mell & Grance, 2011). Although it is in its early stage and all its potential benefits are yet to be explored, it has been considered as an alternative, cost effective and efficient solution to host the large projects like e-government in future (Zhang et al, 2010). Cost effectiveness, geographical location independence, scalability, reliability, elasticity, and security are some of the key characteristic of cloud computing, capable of compensating the challenges faced by the electronic government projects (Zissis & Lekkas, 2011). Specifically, due to limited budgets of many governments, cloud computing and its advantages are interesting for the public sector (Armbrust et al., 2010). Alford & Morton(2009) estimates a saving potential between 50 to 67% by moving governmental applications into private or public clouds.

For organisations, shifting to the cloud means having the ability to contract for computing services on-demand, rather than having to invest on information communication technology infrastructure, software and support personnel necessary to provide a given level of services (Prasad & Atukuri, 2012). In the context of the developing countries, cloud computing leverages the existing information communication technology infrastructure allowing them to deploy electronic government project (Mell & Grance, 2011). Furthermore, Cloud computing permits to

uniformly cover the whole country with e-government solutions, independently of divergence of local administrative units that may be better or worse prepared to provide e-services (Tripathi & Parihar, 2011). Thus it is considered as a cost effective e-government implementation solution that supports government to provide more efficient and effective service. Although the background has shed light on several issues (technological, organizational, economical, design) in the existing e-government projects, there is very less study has been done to address these issues. Beside these common problems, every country has faced unique challenges while initiating the e-government projects. The proposed research outlines these problems in Nepali context. Nepal is one of the developing countries in south Asian region that has taken initiative to implement electronic government. While comparing with the Heeks's definition of failure and success of the electronic government, currently Nepal is in between fail and success.

Quite a few researches have been conducted since the initiation of the electronic government master plan to assess what went wrong. Dharmi & Futo (2010) and Kharel & Shakya (2012) have investigated and identified several issues, technical (Hardware and software), financial (Installation cost, implementation cost and maintenance cost), organisational, political, ethical and social barrier, which has obstructed government from achieving its e-government goal. Despite the identified issues are real, the researcher found them incomplete. Thus, this research is believed to bridge the gap by leveraging the knowledge in the subject domain.

1.3.Context of the study

Nepal, one of the developing countries in the south Asian region has been taken as a context of this study. The study investigates e-government initiative in Nepal, its achievement, implementation challenges, and the current electronic government maturity stage by comparing with the e-government maturity models. This study will follow empirical investigation as the researcher intends to gather data by observation and experience. Action research method employing case study is used to minimize the risks that the research bears. Action research will contribute to acquire new theoretical knowledge while providing practical value to problem domains. Data collection and analysis is done in the context of electronic government master plan Nepal. The research has adopted both quantitative and qualitative method for data collection and explanatory and descriptive approach of data analysis.

1.4.Problem domain

The literature review in the subject domain has provided a common understanding on the sustainability issues of the e-government services. Among the various issues we specifically focused on two key issues that governments in the developing countries have been suffered from. Thus, to attain sustainable e-government services these issues needs to be addressed.

- *Lack of citizen-centric e-government approach*

Lack of citizen-oriented service delivery approach is one of the major reasons behind the failure of electronic government services in developing countries. Much of the efforts have been put to improve the supply (government) side while demand (citizen) side is overlooked. Poor access to the information communication technology, trust in the e-government services and awareness are some of the key factors those influence user intention to adopt the e-government services. In such a situation, thee-government services are failing to acquire wider acceptance and adoption from the user. In the context of Nepal, we found that government has adopted Government to citizen (G2C) approach of e-government implementation. While government has succeeded to establish online portal for various ministries and department, poorly assessed citizen demand has made them less usable. When electronic government master plan was announced in 2006 only 1.14 percentages of the people had access to the internet among them only 963 were broadband user in country (World Bank, 2014) and the situation has not been changed much so far. World Bank (2012) internet user index shows only 11 percent people in Nepal have access to the internet service and most of them use mobile internet. Hence, the implemented e-government services are not easily accessible to the citizen making the services less sustainable. Therefore, it is imperative to address the adoption concern of the e-government services for sustainability.

- *Lack of streamlined e-government services*

Lack of streamlined e-government services is another key problem in the developing countries. The government departments need to integrate and collaborate to delivery streamlined e-government services. However, the initial investigation shows that the governmentsin developing countries are failing to streamline the e-government services. Governments in the developing countries therefore ended up with the several individual application and e-government services those are often incomplete, less effective,require

extra government resources to run and results in a poor customer experience. The streamlined services are achieved through Integration of the e-government systems and application those run individually. The lack of attention to the integration has resulted in the three-significant problem in e-government implementation; (a) Interoperability (b) Data replication and (C) Data silos (Matavire et al., 2010).

The above problem is mainly contributed by the existing e-government maturity model, those emphasise on the transaction services rather than streamlined services. All the existing e-government maturity model arranged the e-government assimilation process in such a way that the governments must provide transaction services (government to citizen) before the integrated services (government to government). Therefore, a new e-government maturity model is required that supports the governments to delivery streamlined services for sustainability.

1.5. Research questions

To achieve the research, aim and objective the following key research questions have been identified.

1. Why are e-government projects in the developing countries failing?
2. What impact does an e-government maturity model have on the sustainable e-government services design?
3. What are the necessary determinants for sustainable e-government services?
4. What e-government approach can be adopted to deliver streamlined government services?
5. How to develop a sustainable driven e-government maturity model?

1.6. Research aim and objectives

The aim of the research is to propose a sustainability-driven e-government maturity model (SDEGM) from the perspective of the developing countries. The Following objectives have been defined to achieve the research aim.

- To investigate the issues within the existing e-government maturity model and their impact on the usable e-government services.
- To identify the determiners from a holistic perspective for sustainable e-government services.
- To develop a sustainability-driven e-government maturity model (SDEGM)

from the perspectives of the developing countries.

- To evaluate the usability and adaptability of sustainability-driven e- government maturity model.

1.7.Significance of the study

Few attempts (Myeong, et al., 2014, Bwalya & Mutula, 2016, Khamis & van der, 2016) have been made to assess the factors effecting the sustainability of the e-government services, however these efforts are not enough towards providing a comprehensive solution. None of the study seems to have considered the e-government maturity model as an issue in designing sustainable e-government services in the context of the developing countries.

Myeong, et al.,(2014) have conducted an empirical investigation to find a relationship among trust, digital divide and e-government sustainability. They found that trust and transparency in the information flow is crucial for the sustainable e-governance. Although the findings are useful they themselves indicate the limitation of their study. They do not offer any solution for increasing the trust and the bridge the digital divide. Islam (2008) proposed a framework for sustainable e-participation, where he describes how government could acquire wider participation from the user in the e-government activities. He mainly focused in the capacity building and policy building where users are encouraged to adopt the e-government services. However, lack of implementation of the framework and any technical detailing on how the framework support to build capacity remain limitation of the work. Khamis & Weide (2016) have also proposed an e-government framework for the countries with low information communication technology (ICT) infrastructure situation. Their framework lacks the adoption side of the e-government services.

Therefore, this research will contribute by proposing a sustainable driven e-government maturity model that will adopt a comprehensive approach of e-government services delivery and adoption as shown in figure 1.1. The figure represents proposed SDEGM and its components that shows how the model has been developed through various stages of the research. The figure also includes the evaluation of the approach and its contribution to the knowledge domain.

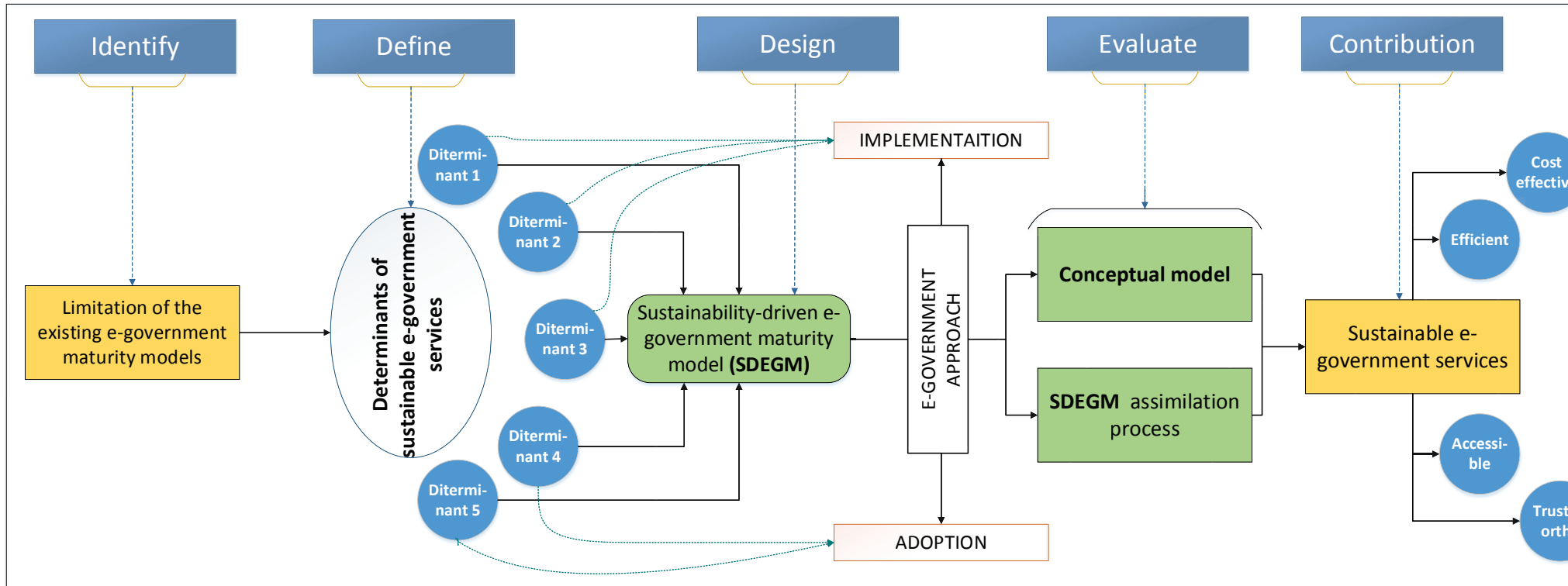


Figure 1.1: SDEGM development process

The significant of the proposed model can be outlined in the following points.

- The research contributes by identifying the limitation in the existing e-government maturity model and their impact on the sustainable e-government service.
- The research contributes by identifying different determinants of the sustainability-driven e-government model and adopted them to design a new model.
- Contributes toward proposition a sustainability-driven e-government maturity model (SDEGM) that support the governments to achieve sustainable e-government services.
- Contributes towards proposing a cloud-computing based solution to support the e-government approach defined by the sustainability-driven e-government model.
- Contributes towards identifying different accessibility channels for the e-government services and e-transaction methods to achieve citizen-centric e-government services.

1.8. Structure of the thesis

The thesis has been organised in four parts extracted from a handbook “How to get a PhD” written by Phillips and Pugh (2002).

- **Background theory:** The first and second chapter followed the background theory. The chapter deals with the rationales, gaps in knowledge, background to the subject, problem domain and literature review.
- **Focal theory:** The third and fourth chapter followed the focal theory. Focal theory deals with the question like “what is the subject of research, and why is it being researched?”. This stage is focused on the proposing solution to the problem domain and development of argument or hypotheses.
- **Data theory:** The fifth and sixth and seventh chapter followed the data theory. Data theory deals with the research methodologies and data analysis. It discusses the rationales for selecting the methodology and data analysis method and presents synthesis of the findings.
- **Contribution:** The eighth chapter followed contribution. The significant of the outcome and its importance to the development of the discipline is discussed in

this section.

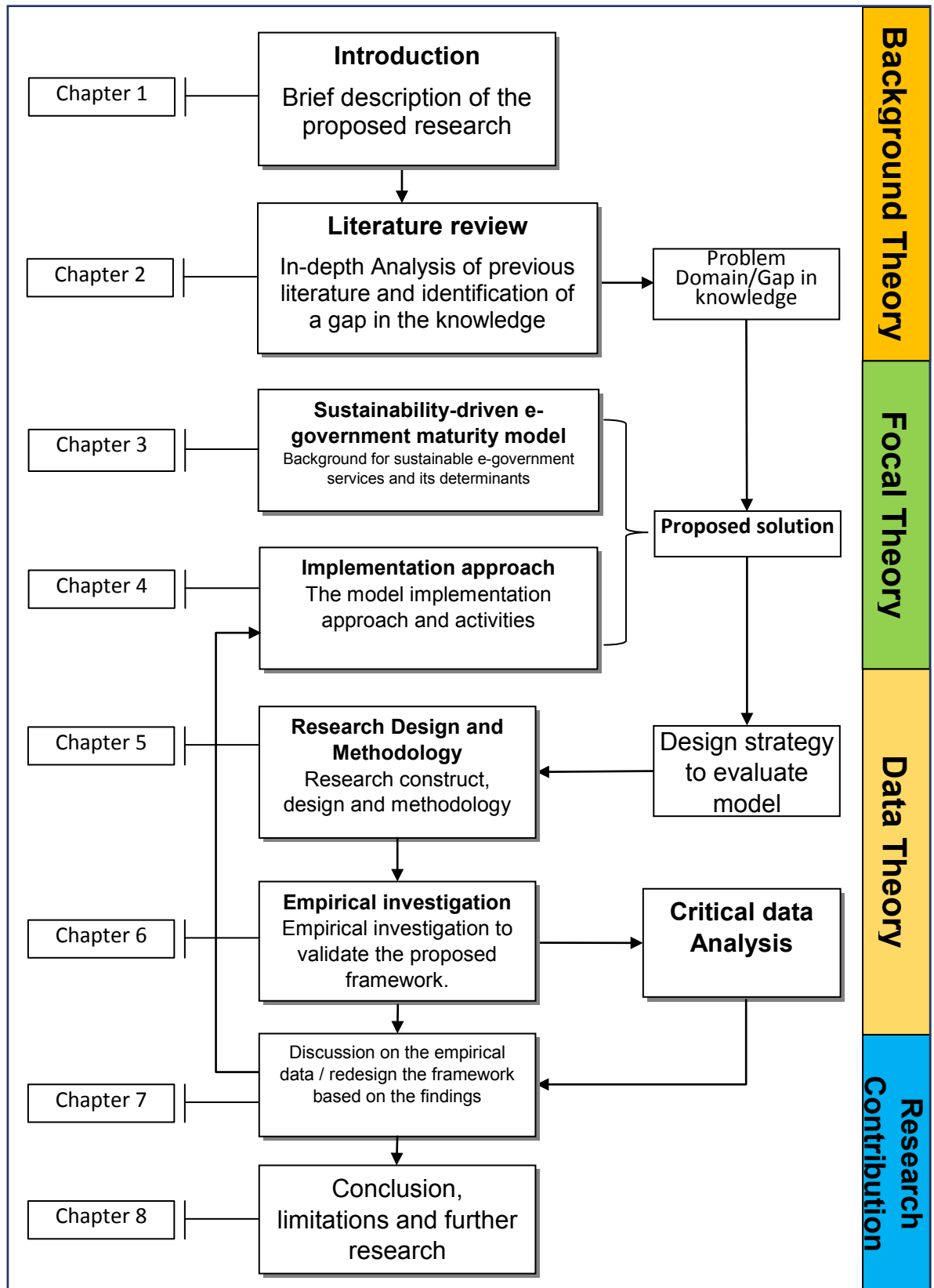


Figure 1.2: Thesis outline

The above figure shows organisation of the thesis. The chapters are briefly discussed below.

Chapter 1: Introduction: *This chapter covers introduction, aim and objectives, need and significant of the purposed research and research plan.*

Chapter 2: Background and Literature review: *The aim of this chapter is to provide rich insight in to the subject domain. Electronic journals, books, reports, online resources such as blogs, social media, newspaper and magazines will be used to form the shape of literature review.*

Chapter 3: E-government maturity model: *This chapter present a new e-government maturity model that has been developed by accommodating different determinants of sustainable e-government services.*

Chapter 4: Implementation approach: *This chapter provides concepts, stages and activities required to implement proposed model.*

Chapter 5: Research design and methodology: *This chapter present research design and methodology used to validate the proposed e-government maturity model and cloud-based e-government framework.*

Chapter 6: Empirical investigation: *This chapter covers an empirical investigation to validate the proposed framework. The framework has been validated using different techniques.*

Chapter 7: Discussion and findings: *This chapter present the analytical review of the data received from the various research methodologies applied to validate the framework. The findings then used to compare with the hypothesis and amend the conceptual model based on these findings.*

Chapter 8: Conclusion, limitation and recommendation: *This chapter presents the conclusion, limitations and the recommendations for the future study. The conclusion will be drawn from the discussion and the findings of the study conducted using various techniques.*

1.9.Summary

This chapter presents the introduction of the research in brief. The chapter has highlighted the problem and the gap that exists in the subject domain. It provided the rationales and contribution of the study. Research aim and objectives have been clearly defined and research questions have been presented. The chapter also provides the study

Chapter 1: Introduction and Background of the research

context, and how the researcher intended to collect the data. The research outline and arrangement of the chapter has also been presented in this chapter.

An in-depth analysis and discussion of the existing literature is presented in this chapter. This chapter gives an opportunity to realize the importance of the research study. This is an overall Summary of the work already been done that identifies the gap exist in the subject domain. The purpose of this chapter is to develop an in-depth understanding on the issues faced by the e-government projects in the developing countries and the initiative taken by the governments to overcome the challenges. One of the distinct areas of focus remains, the e-government maturity model while conducting literature review.

The chapter starts with an introduction of the electronic government that is followed by the concepts of the electronic government, existing model of electronic government, challenges posed by digital divide in e-government implementation, essence of cloud computing in public sector, cloud types and best practice in public sector and security concern on cloud-based e-government.

2.1. Introduction

Moon (2000) said information communication technology has become an essential element of business process reform that has changed the way, how people and businesses interact with each other. Private sectors have made significant progress in integrating information communication technology in their business process to support the better performance of the business and to acquire greater customer satisfaction (Brynjolfsson & Hitt 2000). This has resulted in the raise of the customers' expectations on the government service delivery approach (Parent, 2005), and pressure had been built on the governments around the world to transform the government activities by adopting information communication technology (Anttiroiko, 2008). By using these technologies governments aim to improve the quality of the service and allow business and citizens to access those services in more convenient, effective and efficient way (Fang, 2002, Gartner 2000, Almarabeh & Abu Ali, 2010). The concept of Implementation of the information communication technology particularly internet for the government service delivery and to interact with the different government service stakeholders is known as E-government (Fang 2002). Some of the e-government definitions are noted below.

- The World Bank: "E-government refers to the use of information and communication technologies to improve the efficiency, effectiveness, transparency and accountability of government".
- European Commission: "using the tools and systems made possible by Information and Communication Technologies (ICT) to provide better public services to citizens and businesses is e-government".
- United nation: "The employment of the Internet and the world-wide-web for delivering government information and services to the citizens is e-government."

Palvia and Sharma (2007) argue that while different sources have defined the e-government in their own way, the common theme of the e-government is to use of the information communication technology to deliver quality service to the citizen, business and organizations. Although the common them has been remained same, the advancement in the technology has changed the way the electronic government has been seen (Yildiz, 2007). E-government is no more remain as enabling government services online rather it is now being defined as an enabler of the complete democracy (OECD, 2003, Gartner, 2000), as the government stakeholders could directly involve in the

government decision making process and could influence the government operations in the way they want (EU 2004).Black & Harries (2000) also agrees that e-government empowers the people by leveraging their access to the government information that allows them to actively participate in government policy and decision-making process. As the applicability of the e-government raises Abdullah et al., (2012) noted that the e-Government is becoming a priority in all over the world, and this priority is growing rapidly in developing countries. As a result, there has been a substantial progress made in e-government initiatives during the last decade (Lofstedt, 2012).

Fang (2002) says that one of the most important aspects of e-government is how it brings citizens and businesses closer to their governments. To sum the ideas of e-government, it is important to understand how it works in different dimension. These dimensions can be defined as the types, concepts and model of e-government. The following figure illustrates the different types or the concepts of e-government.

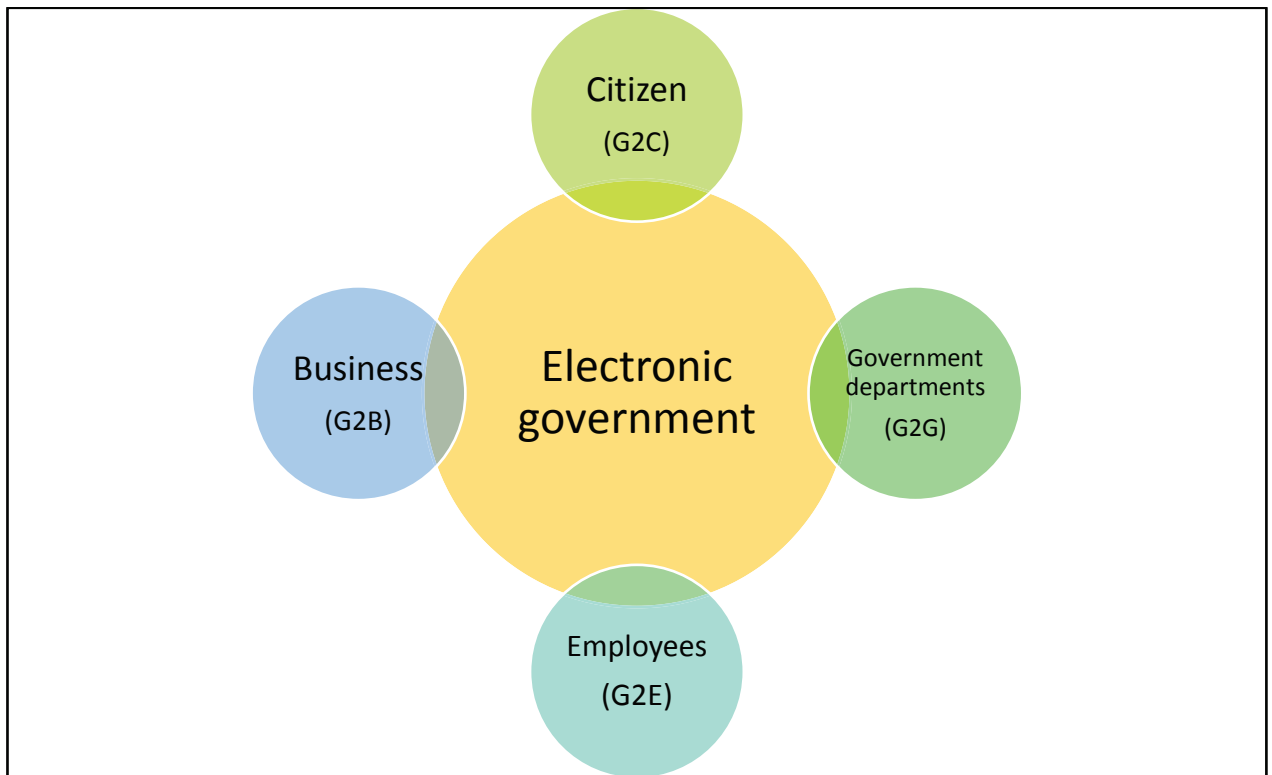


Figure 2.1: Types of E-Government

i. Government to Government (G2G)

This concept emphasizes on the Exchange of information among various government authorities at different hierarchical levels, regarding administrative acts and decision-making. Palvia & Sharma (2007) describe the purpose of government to

government concept is to make the governance more efficient in various aspects, this include reducing cost by going to paperless interactions among government agencies and department, staffing cost, or communicating with private citizens or public government. Effective communication and information flow among the government department is the basic and most important aspect of the effective service delivery (Fang, 2002). To materialize a single access point, collaboration and cooperation among different governmental departments and agencies is compulsory (Ndou, 2004). The information flow among the different government department would be limited unless they are interconnected, in particular big and decentralized countries where there are state, central, and federal governments the limitation of the data and information sharing would cause redundancy and duplication (Evans & Yen, 2005).

ii. Government to Business (G2B)

Lee et al., (2005) says the government to business concept emphasize on building the smooth and trustworthy relation between the businesses and government agencies. As the businesses are the backbone of every governments and nation it is very important to make hassle free, time, cost and effort saving environment that would encourage business investments and improve relationship between government and businesses (Ndou, 2004). Electronic government provide such a platform where the government and business could interact effectively, for example paying business taxes, opening new business, getting information on the government regulations, business licences, registers, laws, business programs, business policy, administrative responsibilities, etc., have never been so easy before the e-government came in existence (Fang, 2002, lee et al., 2005, Reddick 2004, Seifert 2003). Whereas government could take advantage of online delivery of service and posting of results; electronic transactions of accounting, e-auditing, e-procurement etc (Evans & Yen, 2005). Some of the example of G2G dimension of e-government are e-Tender, e-procurement and financial support for business.

iii. Government to Citizen

West (2004) says that citizens are at the centre of every governments thus the success and failure of the electronic government projects hugely depend upon the adoption and participation from the citizens. The government to citizen (G2C)

concept emphasises that the ultimate goal of the electronic government is to provide its citizen seamless services where and how they want (Fang, 2002). Ndou (2004) also believes that the uses of ICT would enable greater freedom in terms of time and location to get government services; he further says most importantly it allows government agencies to directly interact with the citizens eliminating the interference from the bureaucrats. For example, one of the most popular benefits of G2C is the simple posting of forms and registrations that were previously only available to those who were willing to wait in long queues (Evans & Yen 2005, Lee et al., 2005, Reddick 2004). West (2004) have presented wider perspective of the Government to citizen dimension, he says beside the freedom of time and location free access to the government services, the G2C dimension of the e-government empowers the citizen by involving them in the government decision making process.

iv. Government to employee (G2E)

Employees are the backbone of every governments. Employees in the different government departments and within the government departments needs to interact and communicate with each other to run day to day government activities. In this context it is essential to have an effective communication mechanism in place to make this procedure simple and easier (Chavan & Rathod, 2009). (Fang, 2002) says in the e-government vision, the G2E solution is about empowering employees to assist citizens in the fastest and most appropriate way, speed-up administrative processes, and optimise governmental solutions. Silcock (2001) says civil servants will be able to link efficiently with other departments, rely on the latest news, draw on the available resources in an optimal way, and use the most appropriate support. The benefits provided to the governments within this interaction are an empowered pro-active workforce, streamlined efficient communication and workforce retention (Moon 2002).

2.2E-government implementation initiatives around the world

Governments around the world uses one or another model of e-government to implement their e-government projects. These models are often decided according to the needs of the particular government and the availability of the technology to them. There is huge gap among the countries in relation to the e-government development, countries

like, UK Singapore, Korea, and USA are leading the development whereas countries like Nepal, Bhutan, Bangladesh and Pakistan are struggling to adopt the e-government. This section discusses how different countries has achieved success in implementing e-government services.

United Kingdom:The UK government initiative to implement the e-government has started as early as 1994 when a central government website “open.gov.uk” has been established. Since then the e-government projects in the UK has been continuously evolving and improving. According to the UN (2018) report the e-government of UK has been ranked in 4th position in the world with 0.8999 e-government development index.

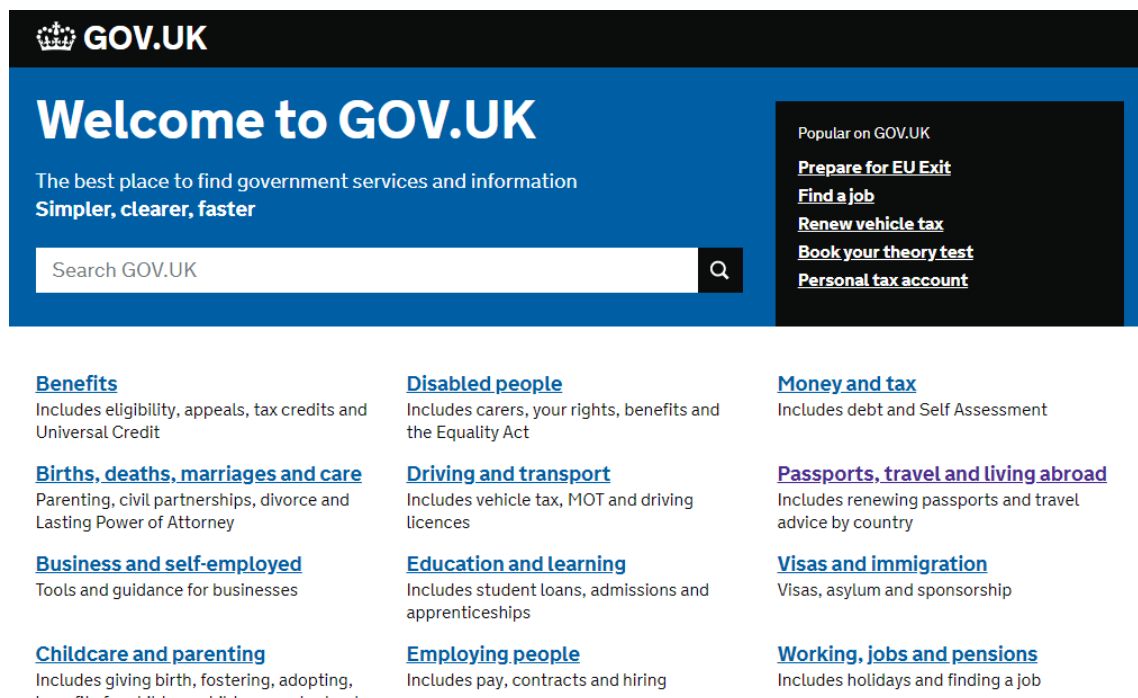


Figure 2.2: UK government portal (Source: Gov.uk)

In 2011 government announced its new ICT strategy for the e-government “G-cloud” aiming to save approximately £1.4bn within the 4 years. Since then it has started to provide government service from the single window portal “Gov.uk”. Gov.uk portal displays important notices on the top of the page so that user can see it clearly. The body of the page presents various categories of the services those can be accessed online. According to the Gov.uk portal all the government department and ministries along with the other government agencies and public body websites are merged into the gov.uk providing a single window access point for all the government services. This is

done by integrating the government services across to the different department at different level. The integration of the services has been made possible by the government G-cloud strategy which not only saved the government cost but also supported the government to rapidly deploy and merge new government services online. According to the Gov.uk about 15 million user have used the e-government services from 9 to 14 January, 2017. It can create huge backlog of work and results in poor customer services if these services required to be manually processed.

United States of America:USA has achieved advance level of e-government maturity. According to the UN report 2018 It is ranked as the second highest in the world for its commitment in cyber security. However, in terms of the EGDlit is 11th country in the world with 0.8769 score.

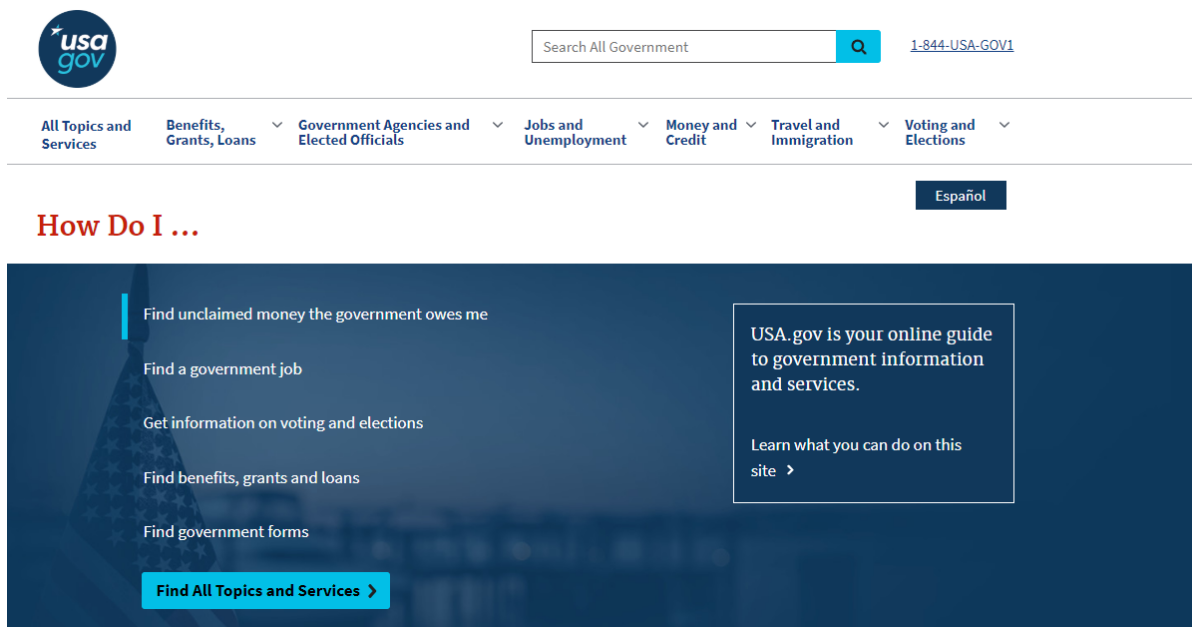


Figure 2.3: USA government portal (Source: USA.Gov)

According to the GSA.gov who also manages five E-Gov initiatives; USA Services, Federal Asset Sales, E-Travel, Integrated Acquisition Environment, and E-Authentication, by adopting cloud computing platform the government aim to reduce the costs and time of e-government services deployment. It states that the poor management of the technology investment, the federal government has missed out from the transformation, as some the traditional e-government projects sometimes become obsolete by the time they are completed. Therefore, in 2010, the U.S. began moving the

federal government's databases to private-sector cloud services. It was intended to help domestic companies build performance while reducing data management costs.

South Korea:South Korea is one of the leading and early e-government adopter country. The initiative of e-government has started as early as 1967 as a part of office automation effort. The formal and significant work has been started in 1980s where Korea began to implement information communication technology across the government agencies. Although the e-government initiative has started in late 80s, the first government services launched online only in 1998 when the government homepage went online.

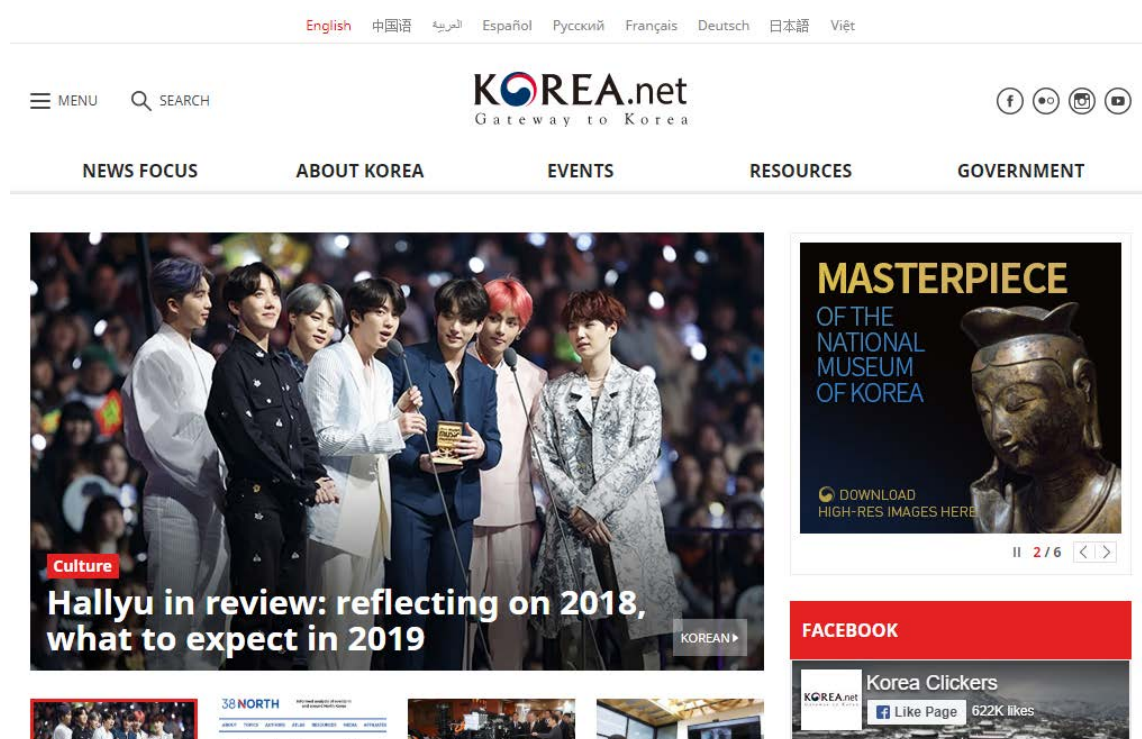


Figure 2.4: Korea government portal (Source: Korea.net)

Whereas many countries are adopting third party services to leverage their potential in e-government implementation, Korea one of the leading country in the e-government ranking has adopted strict policy in relation to their e-government system management. According to the Ministry of the interior and safety, some 19,000 G2G and G2C services are provided by the Korean e-government. Although it manage and operate

such a huge number of services online, the government strictly manage their e-government system and database in-house. South Korea also share their experience in the digital government with the other developing countries, i.e. Nepal and Sri Lanka and support them to initiate the e-government projects.

Sri Lanka:One of the developing countries in the south Asia Sri Lanka has achieved significant success in implementing e-government services. According to the United Natation (2018) report Sri Lanka falls in high EGDI ranking countries those have EDGE between 0.50 and 0.75.

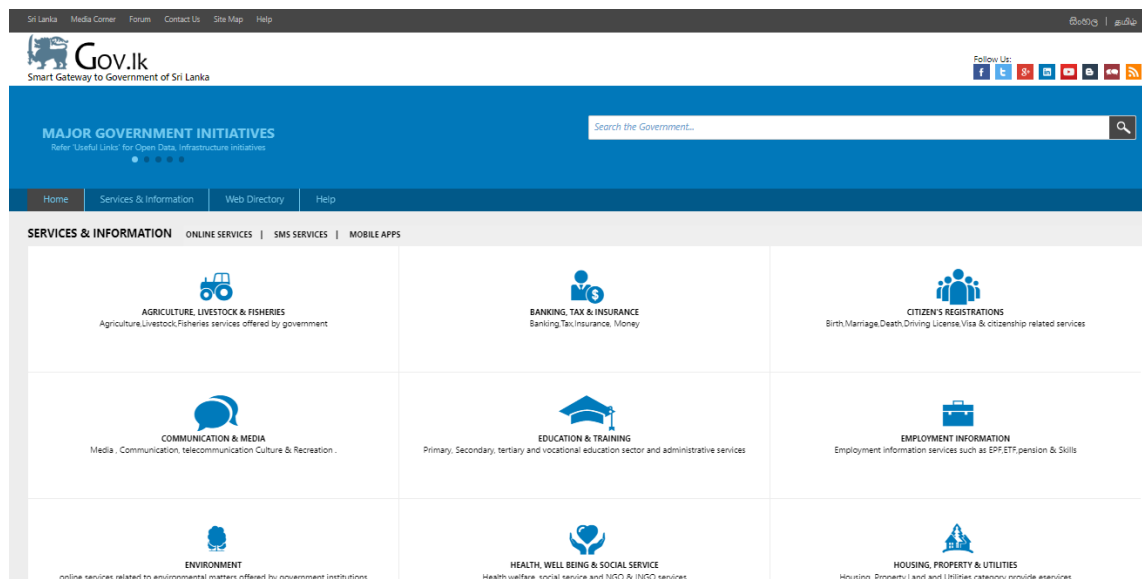


Figure 2.5: Sri Lanka government portal (Source: Gov.lk)

Sri Lanka has been providing range of e-government services, i.e. electricity bill view and payment, search audit report, property taxation, Complain about Bribery or Corruption, etc, through its single window portal Gov.lk. Sri Lanka has recently announced its e-government strategy, which is called re-engineering e-government. The aim of the government ICT strategy is to deliver integrated services for greater customer satisfaction and providing the government services with ease and connivancethrough a responsive and networked government. This will be done by adopting cloud based e-government.

2.2. E-government design and implementation approaches

There are different approaches of electronic government design and implementations around the world. Ebrahim & Irani (2005) found that E-government design and implementation approach has a huge impact on the sustainability of an e-government project. Carter and Belanger (2005) say the growing interest in e-Government raises the

question of how governments can increase citizen adoption and usage of their online government services. As the electronic government projects are aimed to reduce costs and provide greater range of service to its users compared to the traditional method, it is especially important to adopt an appropriate design and implementation approach (Layne & Lee 2001, Reddick 2010, Chen 2010). The electronic government projects could be distinguished as technology centric and user-centric based on the design approaches.

Technology (service) centric vs. User-centric Approach

Scholl and Klischewski (2007) found its tricky task to select user centric or service centric electric government model as both seems equally important, however adopting the best option is critical for the sustainable system. The most common error in electronic government projects in the developing countries is failing to identify the appropriate model (Helbig et al., 2009). The properties and the limitations of the user centric and technology (service) centric e-government implementation approach shown in the following table.

E-government design approaches	Properties	Limitations
Technology (service) centric approach	<ul style="list-style-type: none"> - Sophistication of services - use of high-tech technology - focus on Supply of the services 	<ul style="list-style-type: none"> - Time consuming - Expensive (projects often abandoned because of the huge cost) - Complex system needs experts and advanced technology
User centric approach	<ul style="list-style-type: none"> - User oriented design - Simple and easy to use - User involvement in design for requirement analysis - User satisfaction (they are built around user capabilities) - Focus on demand of the stakeholders 	<ul style="list-style-type: none"> - Complex (systems used by different stakeholders with different capabilities, addressing those differences could be challenging. - Hard to align with the available technology

Table 1.1: Technology (service) centric Vs. User centric design

Both the approaches have their own characteristics and limitations. Governments often make mistake in choosing appropriate approach. Technology centric design has priority to enable different services by using technology regardless of the end user. In contrast, user centric aims to provide its user ease of use and access to the services. User centred design emphasise in moulding the technology to meet the capabilities of the users rather than automating services by using ICT tools (Endsley, 2011).

Most of the electronic governments in practice are service (Technology) centric. Mukherjee and Sahoo (2010) found that the service centric nature of the existing e-Government projects is unable to address different categories of the users, from rural urban to metropolitan citizens. Similarly, Reddick (2004) argues that much of the existing E-Government literature is from a supply-side perspective and that more attention to demand-side issues are needed. Service centric approach seeks too much attention in technology and use of information communication technology to deliver the government services (Verdegem & Verleye 2009). This model worked in some extents in developed part of the world where the citizens have access to information communication tools to accept the e-government services offered, however these are being substituted by the citizen centric models currently (Bertot et al., 2008). The graph below shows the use of electronic government services by the individual in the different countries.

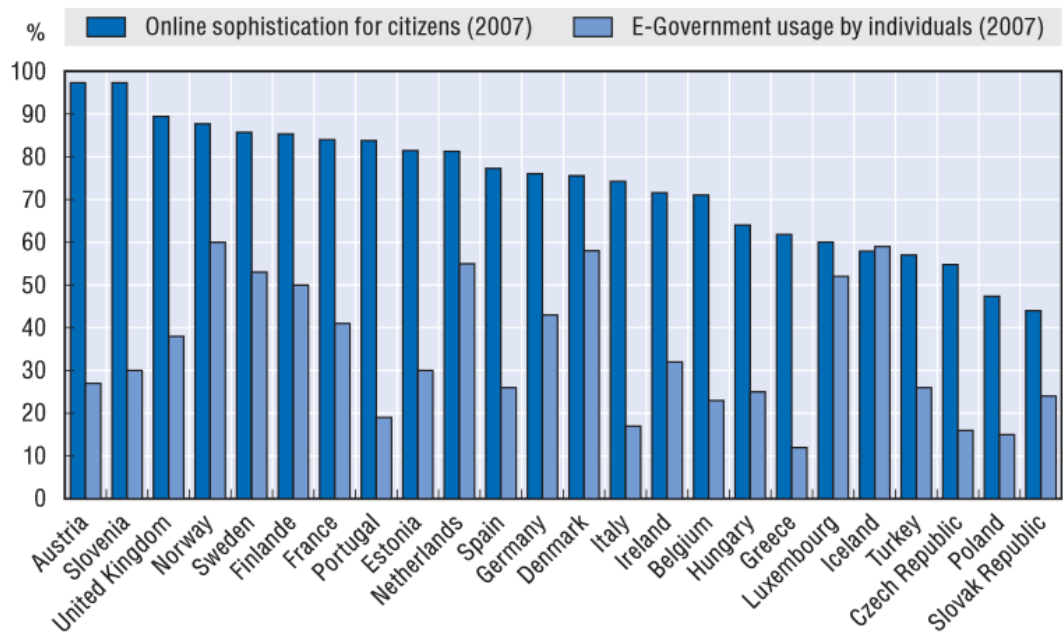


Figure 2.6: Online sophistication and e-government uses by individuals(OECD, 2007)

The above graph shows there is large gap seen in the usages of the services as compared to the services offered. For example, Austria is one of the countries that offer almost 100 percent government service online however the use of those services is only about 25 percentages. This is mainly because of the service centric approach of the electronic government. In technology centric e-government, emphasis had been given in the service delivery but the customer involvement and requirement analysis are poorly done (Coursey & Norris 2008). This creates huge gap in the services offered and acceptances of those services. This gap is lot more in developing countries in comparison to the

developed countries as the stakeholders are poorly equipped and educated to take advantage of the electronic government. User centric approach is mostly used to design the electronic government services in current scenario (Verdegem & Verleye 2009). Developed countries have taken steps to build more sophisticated and user centric system that would result in the greater user satisfaction however developing countries are failing to do so. Less attention has been given to the user requirement and their ability to adopt the changes brought by the technologies often leading the projects to the failure. Ahmad et al., (2012) also noted that the reason of the citizen's not accepting of the e-government services in developing countries is governments failing to realize the need and requirement of the stakeholders. Simply employing technology for the sake of technology would not result in greater citizen participation (Magro, 2012). Until the electronic government able to address the fundamental demand of the user, it can't be successfully implemented (Shareef et al., 2011). Thus, for the successful execution of the e-government projects, it is very critical to address the customer requirements as the adoption and participation on e-government activities is crucial for e-government (Lee et al., 2011, Mukherjee & Sahoo 2010, Conroy 2006).

2.3. Electronic government maturity model and its impact on sustainable e-government services

The design of e-government projects is driven by e-government maturity models, which are often called stage models. A maturity model is a conceptual framework that outlines how e-government projects should be assimilated in stages (Layne & Lee, 2001, Reddick, 2004). Considering the enormity and complexity of electronic government projects, it is often assimilated in stages (Fath-Allah et al., 2014). Several efforts have been made to standardize e-government assimilation stages and to measure the level of maturity that an e-government project has achieved (Andersen, & Henriksen, 2006). This has resulted in the development of the several e-government maturity models (Kim & Grant, 2010). While existing e-government maturity models have been adopted to develop strategic plans to deploy e-government projects, studies (Debri & Bannister, 2015, Zahran et al., 2015) show that an increasing number of e-government projects in developing countries are failing to align with the patterns of e-government maturity models, resulting in poor sustainability of these e-government services. The word sustainability has been loosely used to define the efficiency that a government could achieve in terms of cost, time, and effort to implement e-government services, while

being able to accommodate the interests of various stakeholders (i.e., the government and citizens).

The implementation of fully functional e-Government incorporates several stages. Since the evolution of the e-government, efforts have been made to standardize the e-government assimilation process and to measure the level of maturity that a government has achieved in e-government (Windley 2002). These efforts have resulted in the development of the many e-government maturity models. The objective of these models is to illustrate, how electronic government projects are assimilated in various stages. These models emphasise on how government should initiate the electronic government and gradually move towards fully functional electronic government. The stages of the maturity models began with the simple and progress towards the more complex stages. While the authors Siau & Long (2005), Asia Pacific (2004), Deloitte & Touche (2001), Shahkooch et al., (2008) have proposed maturity models those have several stages as they stressed that the maturity models with less stages are more complex to implement, time consuming and require huge resources to complete. Therefore, the maturity models with the several stages make it simpler to rank the e-government maturity level and to understand the e-government assimilation process (Asia Pacific, 2004). The table 1.2 shows the government stages models based on the number of stages.

E-government maturity models						
Model	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Reddick (2004)	Catalogue	Transaction	X	X	X	X
Howard (2001)	Publish	interact	transact	X	X	X
World Bank (2003)	publishing	Interactivity	Complete transaction	X	X	X
Layne and Lee (2001)	Catalogue	transaction	Vertical integration	Horizontal integration	X	X
Windley (2002)	Simple website	Online government	Integrated government	Transformed government		
Anderson & Henriksen (2006)	Cultivation	Extension	Maturity	Revolution	X	X
Gartner (2000)	Web presence	interaction	Transaction	Transformation	X	X
Chandler & Emanuel (2002)	Information	interaction	transaction	integration	X	X
West (2004)	Billboard	Partial service delivery	Full integrated service	Interactive democracy with public outreach and accountability	X	X
Moon (2002)	Information dissemination/catalogue	two-way communications	service and financial transaction	vertical and horizontal integration	political participation	X
UN/ASPA (2002)	Emerging	Enhanced	interactive	transactional	fully integrated	
Safari et al. (2004)	close	preparation	develop	manage	seamless	X
Siau & Long (2005)	Web presence	Interaction	Transaction	Transformation	e-democracy	X
Hiller & Blanger (2001)	Information dissemination	Two-way communication	Service and financial transaction	Vertical integration	Horizontal integration	X
Shahkooch et al., (2008)	Web presence	Interaction	Transaction	Transformation	Digital democracy	X
Davison, Wagner, & Ma (2005)	E-government “Rhetoric”	government vision	Strategic Plan	Government integration	E-government transformation	X
Kim, D. Y., & Grant (2010)	web presence	Interaction	Transaction	Integration	Continuous improvement	
Asia Pacific (2004)	Email system and internal network	inter-organisational and public access to information	Two-way communication	Exchange of value	Digital democracy	Joined-up government
Deloitte & Touche (2001)	Information publishing	Official two-way communication	Multipurpose portal	Portal personalization	Clustering of common service	Integration and enterprise transaction

Table 1.2: E-government maturity models based on the number of stages

The existing e-government maturity models comprise two to six stages. Among the existing models, the most discussed and cited ones have a maximum of six stages. Reddick (2004) proposed a two-stage maturity model which defines the maturity stages as a catalogue, where governments arrange information in a catalogue accessible by citizens and businesses, and a transaction, where governments offer full-fledged e-government services. Howard (2001) developed a three-stage model with stages named publish, interaction, and transaction, where governments initially publish information online, then interact with stakeholders online, and finally, allow users to have online transactions. Layne & Lee (2001) Andersen & Henriksen (2006), Gartner(2000), Chandler & Emanuel (2002), and West (2004) adopted much balanced approaches to government maturity models, where they emphasized that e-governments could reach maturity in four stages. Among these models, Gartner's maturity model is slightly different from the others. It argues that e-governments could achieve transactions in the third stage, whereas others put the transaction phase in the second stage.

Some authors; Hiller& Belanger (2001), Moon (2002), Shahkooh et al., (2008) and Siau et al., (2005) developed five-stage models, particularly for developing countries where e-government assimilation takes place at a slow pace. Some comparatively old models, namely the Asia-Pacific (2001) and Deloitte (2000) models, further broke down the assimilation process, and proposed six-stage maturity models. These models provide a slower assimilation process where the government starts from a very basic point, such as using an email system, and makes small-increment and progress toward maturity. While assessing the existing e-government models, we found that they have very few distinct differences; in fact, most of the models have inherited stages from previous models, and loosely modified within the contexts of various countries. Howard (2001) and the World Bank (2003) developed almost identical maturity models, which shares a similar number of stages using same metaphors for the stage name. These models argue that e-government implementation is done in three stages, where governments initiates an e-government by publishing (website), followed by two-way communication and finally implements the transaction stage. The maturity level of e-governments is purely portrayed as an e-commerce, where the government's goal is to transact with stakeholders electronically. Similarly, Gartner (2000), and Chandler & Emanuel (2002) developed four-stage maturity models which also have very similar stages. The two differences were the metaphors used for the first and last stage. Gartner (2000) presented the transformation of government services as maturity of the electronic

government, whereas integration is proposed at the maturity stage of the e-government in Chandler & Emanuel's (2002) model. Siau & Long (2005), and Shahkooch et al. (2008) have stages identical to those of the Gartner (2000) maturity model. The only difference between the Gartner (2000) model and the other models is the number of stages. The other models have five stages, and proposed e-democracy or digital democracy as the maturity level of the electronic government. These models defined electronic government in a much wider perspective than previous models by including a stage where citizens get involved in government activities.

Despite their uses, e-government maturity models also have acquired criticism from several researchers: Coursey & Norris (2008), Debri & Bannister (2015), and Zahran et al. (2015). They observed several limitations in existing maturity models. Coursey & Norris (2008) analysed maturity models developed by the Gartner Group, Layne and Lee, and Wescott (2001) and found that the models are speculative and lack the statistical data to support their usability. Furthermore, they noticed that patterns of e-government development at the local level are not supported by these models. Karokola & Yngstrom (2009) described the models as technology-centric that include many buzzwords. According to them, the models focus on the naming of stages, while security requirements being disregarded at each of those stages. Similarly, Lee (2010) studied a dozen e-government maturity models, including his own model developed in 2001, and found that the maturity models are somehow similar other than the metaphors used in each one. He further indicated the need to redesign maturity models to include modern technology available at the time of the e-government's implementation. Debri & Bannister (2015) found that e-government maturity models are descriptive and predictive, and lack practical solutions to achieve maturity of stages. They said that existing maturity models present a very narrow definition of e-government, which define e-governments as tools to provide web-based e-government services. Zahran et al. (2015) found that existing maturity models are too simplified and developed based on assumptions. They said there are no facts available to assess how successfully the stages in the models addressed e-government assimilation. They found that the models are supply-oriented and ignore the adoption side. Therefore, considering none of the models as universal, all the above authors developed their own versions of maturity models.

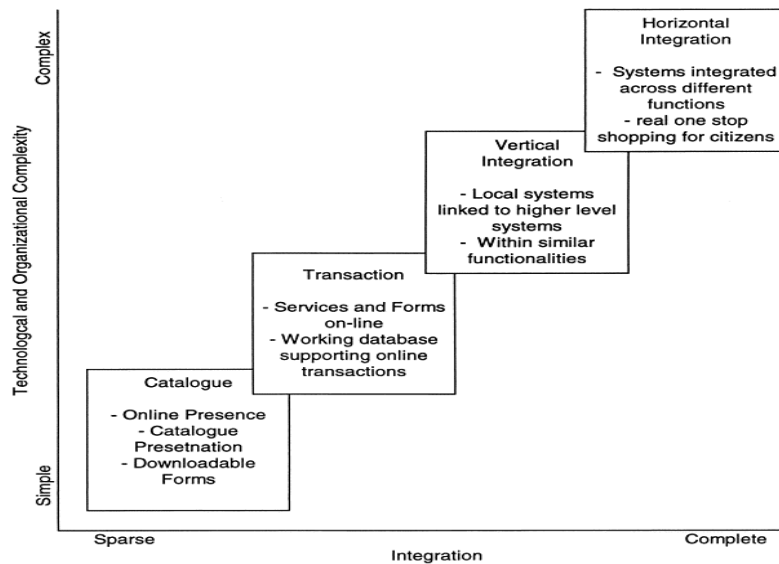


Figure 2.7:Layne and Lee four maturity models(2001)

The limitations could be summarised in the following points.

i. E-government assimilation occurs in a linear pattern

Almost all electronic government maturity models emphasise that the assimilation of electronic governments occurred in a linear manner where the e-government project progress from simple to complex technology (Abdelghany et al., 2016). The models introduced by Layne & Lee (2001), Gartner (2000), the United Nation (UN) (2002), Reddick (2004), and West (2004) argued that a stage needed to be completed before starting the following stage. This may have been partially true; however, modern technology could enable governments to initiate two or more stages simultaneously (e.g., governments could introduce e-governments along with their integration into the government department (Rana et al., 2015). This depends on the government's decision whether it has enough resources to start two stages (e.g., introduction and integration) simultaneously.

ii. Transaction occurs before integration

All existing e-government maturity models agreed that the transaction stage is to be implemented before the integration stage of e-government maturity (see Table 1.3). However, transactions can't be completely achieved without integrating e-government services at different levels. The process of government service delivery needed to go through various authentication and verification processes, and often requires an involvement of two or more government departments working together to complete

service requests from a stakeholder. In such a situation, if those government departments have disparate systems, online services are not delivered effectively and efficiently. Therefore, it is imperative to integrate government departments to seamlessly deliver online government services. A study conducted by the UN in 2014 showed how e-government assimilation stages were achieved.

Countries	Stage 1 Emerging Presence	Stage 2 Enhanced Presence	Stage 3 Transactional Presence	Stage 4 Networked Presence
Service's maturity level in percentages (%)				
Japan	97	73	79	88
Netherlands	100	75	70	88
Estonia	100	66	56	59
Costa Rica	94	55	37	44
Jordan	91	41	21	50
South Africa	75	43	12	24
Indonesia	69	34	9	35
Senegal	78	32	5	15
Kyrgyzstan	81	27	2	9
Zambia	47	16	0	9

Table 1.3:E-government service delivery stages in various countries (UN,2014).

The above table shows that almost all the countries, regardless of their development status, achieved networking/integration of government departments before the transactional stage. A study conducted by Tripathi & Gupta (2014) on the maturity level of the Indian e-government also provided similar findings to those of the UN (2014) report. The government of India adopted a four-stage maturity model to implement its e-government. Tripathi & Gupta (2014) found that, in 2014, fifty eight percent of the e-government services had achieved integration, while only 28 percent of the e-government services had achieved the transaction stage. This clearly indicated inconsistency between the maturity models and the e-government's development. Therefore, maturity models should be designed in such a way that the integration stage is completed before the transaction stage.

iii. Lack of state-of-the-art technology

Supriyanto & Mustofa (2016) said that existing maturity models have failed to include advanced and modern technology in e-governments' developmental stages. Technology has rapidly changed in the last decade. The use of social media has dramatically increased, more people have access to the internet, the global community has become closer, and information has become more open. Many technologies are currently outdated, for example, dial-up internet, static web pages, etc. are rarely used. Therefore,

maturity models should be developed at regular time intervals to include technology of that time (Hollenstein, 2004). Maturity models should be developed in such a way that they can address current problems and consider the use of modern technology.

iv. Lack of a detailed process

Some existing electronic government maturity models are developed to rank the maturity levels of electronic governments (Shahkooh et al., 2008). These models do not provide a strategic solution to achieving stages of an electronic government (Shareef et al., 2011). These models do not say anything about the processes and activities needed to progress from one level to another. The existing models are descriptive and predictive with no factual or technical plan to initiate or complete stages. The stage models proposed by two different organizations, the UN (2002) and the Asia-Pacific (2001), claimed that the models would work best in developing countries. Like the previous models, the UN (2002) proposed an emerging presence where the government establishes their static website as the initial stage of e-government assimilation but does not provide any processes that defined how governments should go for establishing their web presence.

v. Lack of adoption perspectives

Some existing electronic government maturity models rank the maturity of electronic governments based on the technology in use (Napitupulu & Sensuse 2014). Almost all maturity models agreed that governments using sophisticated and advanced technology cloud achieve greater levels of electronic government maturity. However, Debri & Bannister (2015) argued that sophistication of technology may not correctly predict the maturity level of electronic governments. The success of e-governments should not be measured merely based on sophistication of the technology used by the government, but instead, should also consider whether the services offered are being used by the stakeholder (Debri & Bannister, 2015). The ratio of stakeholders using the online services to the services offered also needs to be assessed to evaluate the success of an e-government. However, these facts seem to have ignored by electronic government maturity models. No e-government model has included the user as someone who plays a crucial role in the successful implementation of an e-government (Zahran et al., 2015).

2.4. The impact of digital divide on e-government sustainability

‘The gulf between those who have ready access to computers and the Internet, and those who do not’ is known as digital divide” – Oxford English Dictionary.

Brazilai-Nahon (2006) noted that the definition of digital divide and the empirical analysis of its components is much debated and discussed topic. Since it is complex, and dynamic concept, Digital divide have been defined in the different ways (Dijk & Hacker 2003). Deursen & Van Dijk (2014) say the gap between the people who use computers and internet and the people who do not is digital divide. Compaine (2001) defined the digital divide as the distinction between the people who have access to the information and who do not. Similarly, Chen & wellman (2004) and Sukkar (2004) describes the digital divide as the gap between individuals and societies that have the resources to participate in the information era and those that do not. Campbell (2001), James (2008) Dimaggio & Hargittai (2001) noted that there is gap within the people who have access to the information communication technology and describe the digital divide as the division within the people who have access to the technology and use them effectively and other who do not use.

Digital divide is one of the most significant hurdle faced by the developing countries in e-government implementation (Scheepers et al., 2012). As noted by Kayani et al., (2011) the use of internet in the developing countries is in its early stage, and it is mostly limited within the metropolitan cities. This unequal demographic variation in terms of access and use of the information communication technology is limiting the electronic government projects from delivering the maximum potential benefits to the users (Dada 2006,Venkatesh et al., 2014). Helbig et al., (2009) argues that Using sophisticated information technologies (IT) in government has little social value if citizens are not able to use services or interact with government in meaningful ways. The mismatch of the technology could increase the divide between the government and users, thus the concerns and the abilities of users should be aligned with proposed system (Sipior & Ward, 2009). Warkentin et al., (2002) say that as the user involvement and adoption is crucial for successful e-government projects, the unequal ability and needs of the users make its hard for designing such a system. Carter & Weerakkody (2008) has found that the vast socio-economic differences among the people in the developing countries has created huge digital divide as compared to the developed countries. These divides are mainly caused by the income (most of the people live under poverty line, do not afford to own computer and internet), personal circumstances

(disabilities, age, race, gender) and geography (rural areas in developing countries have little or no access to the computer, internet, electricity etc).

From the previous research it is evident that one of the most used e-service delivery method in developing countries is tele-centre and Kiosk. Rowley (2011) discuss the role of public kiosks in delivering e-government Services to those who otherwise might not have access to these services online. Even though tele-centre and Kiosks could effectively support as an effective node for e-government services, Rangaswamy (2006) found that most of the Kiosks and telecasters in the rural area have been closed or failed to attract the users. There are lots of concerns regarding the telecentres and the service offered through these centres (Pick & Golakota 2010). Helbig et al., (2006) argue that Merely providing computer and internet does not add any value to the government services as the users should be able to use those services.

Thus, even if there are sound policies and e-government strategies in places unless the digital divide among the organization and the individual are minimized they will pose strong constraint in the successful e-government implementation (Fang 2002, Basu 2004, Belanger & Carter 2006). As a result, despite putting all the efforts to offer online services, the full potential of e-government is far from being fully realized (United Nation, 2014). Norris (2001) have defined the digital divide as individual and global.

Individual digital divide vs global digital divide

Cullen (2001) says the difference in capacity to use and own the technology among the people in the particular region, and country is known as individual digital divide. Riggins & Dewan (2005) have found that a particular group of people are disadvantaged in their uptake of ICTs. These includes: people on low incomes, people with few educational qualifications or low literacy level, the unemployed, elderly people, people in isolated or rural areas, people with disability, women and girls (Rowena and Cullen, 2001). As there are many factors causing the digital divide beside the income level of an individual, these divides still exist in the developed and economically strong countries (Norris 2001, Riggins & Dewan 2005, Deursen & Van Dijk 2014). However, in comparison these divides are a lot higher in the developing countries (Chen & wellman 2004).

Castells & Webster(2004) recognized that ICT is the most significant factor separating developed and developing countries. Pick & Azari (2008) describe the global digital divide as the disparities regarding use and access to the computing and internet and disparities in the opportunities derived from those access between the developed and developing countries. Fuchs (2008) says as with a smaller unit of analysis, this gap describes an inequality that exists, referencing a global scale.

Norris (2001) found that the digital divide among the governments is directly influenced by the country's economy. Strong economy has access to the much-advanced technology where as poor economy has less access to these technology (Scheepers et al., 2012). Servon (2008) says high income countries account for over three-fourth of the world's internet user. This is supported by United Nations (2015) survey that shows the Access to ICT infrastructure and the provision of education, including ICT literacy, are highly related to the income level of a nation. Particularly among the lower-middle income and low-income countries, as evidenced by their poor electronic government development index EGDI performance. Having said that the national income has direct influence on the e-government development rank, the advancement of the electronic government does not necessarily depend upon the increment on the national income and strong economy. The figure 2.4 supports the fact that the developed economy are the leader on the e-government development rank.

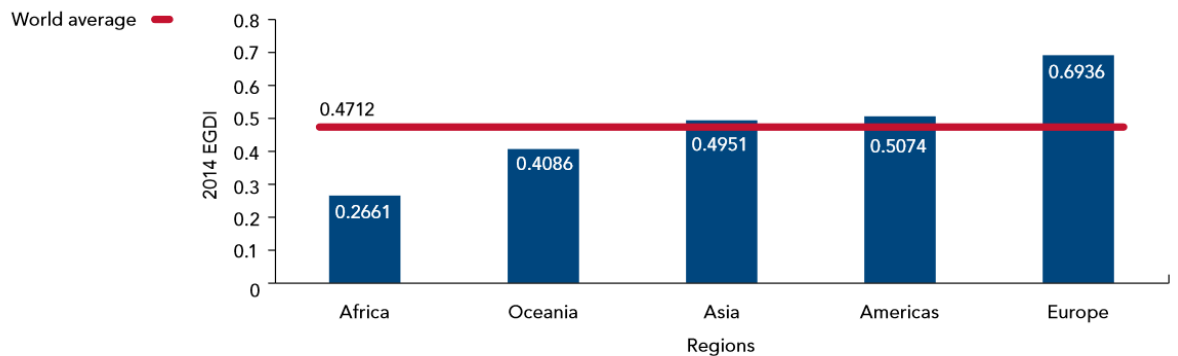


Figure 2.8: Digital divide among the developed and developing countries (UN, 2014)

Clearly the digital divide is much more complex than a mere lack of access to the computer and internet (Servon, 2008). Thus, some of the authors have come up with more inclusive definition; OECD (2001) define the digital divide as a gap in terms of access to and usage of information and communication technology, including the skills to make use of those technology within a geographic area, society or community. While the traditional concept argues about the access to the technology and owning the

technology, Hilbert (2004) says it is no longer a question of having or not having access to the technology, but with a global mobile phone penetration of over 95%, it is becoming a relative inequality between those who have more and those who have less.

2.5. Cloud computing for sustainable e-government service

Information communication technology driven projects often need to be aligned with the innovations and new technologies (Wyld, 2010), and the changing nature of the technology implies governments to constantly upgraded and updated the electronic government infrastructure that poses extra financial burden (Hashemi et al., 2011). Similarly, when a government extends its department, roll out new municipality or make any changes in governance, it needs to modify or build a new infrastructure to accommodate those changes (Low et al., 2011). Therefore, governments throughout the world are making their strategy to move to the cloud-based e-government to reduce spending on technology infrastructure (Kshetri, 2010).

Armbrust (2010) compares cloud computing with the general utility, in which computing resources i.e. CPU, storage and network can be leased or rented on demand. In a cloud computing environment, the traditional role of service provider is divided into two: the infrastructure providers who manage cloud platforms and lease resources according to a usage-based pricing model, and service providers, who rent resources from one or many infrastructure providers to serve the end users (Clemons and Chen 2011, Zhang et al., 2010). Lagar-Cavilla et al., (2009) and Wu et al., (2010) describe virtualisation of a computing devices as the main enabling technology for cloud, where a physical computing device is separated into more than one standalone virtual device capable of working independently. The concept of cloud is to commoditise the computing services and deliver those services in a manner like the traditional utilities such as gas, telephone, electricity, etc, in which users are invoiced according to the uses of the services (Foster et al., 2008, Wang et al., 2010). Unlike the conventional mode of computing where computing is done locally in local infrastructure, Mazzariello et al., (2010) says the goal of cloud is to provide freedom to the users from owning the expensive information communication technology infrastructure yet allowing users to take benefits from these technologies. Beside the cost there is a substantial amount of time involved in setting up information communication technology infrastructure. Thus, the start-up companies and public sector who wish to digitalis their services must wait and leg behind from their counterpart (Ndou 2004). While cloud computing has been

defined as an alternative cost-effective solution for computing, Galante et al., (2012) says service on demand nature and the elasticity of the cloud has brought new opportunity over conventional computing. For example, application servers are designed to handle the maximum possible number of users who will use the service at any one time (Welsh and Culler (2003). This would result in the poor utilization of the server, i.e.wastage of resources at unpick hour and risk of server crash and failure at pick hour if the work load increases more than expected. Cloud computing can handle these types of uncertainty, by balancing the work and utilising the resources at their maximum potential. (Armbrust, 2009). Kundra (2011) has found that the federal government of USA has achieved 60 to 70 percent more server utilization by using cloud.

Cloud computing are always up to date and these updates and upgrades are frequently carried out by the cloud vendors freeing the users from the Burdon of upgrading and maintaining the technology (Liang, 2012). Beside the cost, upgrading the system takes huge time in traditional electronic government, Microsoft UK government industry manager, Richard Shipton says “Traditionally you might be looking at a six month or a year’s project to buy and install extra storage. Now you can do it just by going to a web page and using your government procurement card.” According to the Gartner Inc., the world’s leading information technology research and advisory company, by 2018, at least 30 percent of service-centric companies will move most of their Enterprise Resource Planning applications to the cloud to address the growing challenges to cut the cost of the ICT infrastructure.

Zhang and Chen (2010) and Khan et al., (2011) have discussed the impact of shrinking budget in the e-government projects and government initiatives to shift from traditional to cloud based e-government. While electronic government projects are facing number of challenges (Wang et al., 2015) has seen the cloud computing as a future solution for those challenges. Cloud computing has opened new channels for the governments to deploy the electronic government projects and deliver their services even more effectively and efficiently (Smitha et al., 2012). Today, public sector ICT is characterised by high levels of duplication, silos of infrastructure, fragmented and often inappropriate provision and low levels of server utilisation. It is estimated that in some cases, ICT infrastructure utilisation in government is less than 10% (Government Cloud Strategy, 2011). Smitha et al., (2012) says integration of the cloud computing in e-

government could solve numbers of problem including data duplication, low resource utilization rate, repetitive infrastructure construction, and information isolated island. Beside this the governments could be benefited from overall cost reduction, distributed data storage, scalability, accountability, modifiability and security management by using cloud computing (Mukherjee & Sahoo2010, Kshtree 2010, Chanchary& Islam 2011, Wyld 2011). Furthermore, Hashemiet al., (2013) says moving to the cloud-based e-government from the traditional, opens new channel of service and creates new business opportunities while improving government performance.

Traditional e-governments are not scalable or cost a lot to change their capacity (Goel et al., 2012). A typical example of the traditional e-government system failure because of the lack of scalability is Transport for London's real time train tracking system failure in 2010. Transport for London had built an app to track the underground train in real time. The app became so popular that the TFL's servers struggled to cope with the sudden increase in demand. To address the problem TFL moved the application from its server to the windows-based cloud, Azure and now the system is comfortable handling about 2.3 million hits it receives each day. Michael Gilbert, transport of London (TfL)'s chief technology officer accepts that if they had to run the application on their own servers it would have not been financial achievable as it would have cost them huge amount to build a new infrastructure inside their data centre.

A study shows, the federal government of USA is the world's largest consumer of information technology, spending approximately \$80 billion annually on more than 10,000 systems (Kundra, 2011). Among the pioneer governments who has decided adopt cloud, the federal government of USA has been shifting its data to the cloud-based storage from the agency owned data centres since 2009 (Figliola & Fischer, 2013). Armbrust et al., (2010) found that the governments are making huge savings by moving to the cloud platform. The government policies have aimed to reduce these centres by 40 percent and expected to save billions of dollars by migrating IT service to the cloud platform.

2.6. Challenges in cloud based electronic government

Along with the opportunity cloud computing has brought several challenges, especially when it is matter of national interest and involve dealing with extremely classified and confidential data and information, government should be more cautious while

considering adopting the cloud based electronic government (Janssen & Joha, 2011, Zhang et al., 2010). Brodtkin (2008) found it hard for governments to alter the application feature when needed as the government lacks access to the physical infrastructure. Obtaining cloud computing services can be viewed as a form of outsourcing, and as such it shares the essential risk profile of all outsourcing contracts concerning opportunistic behaviour, shirking, poaching, and opportunistic renegotiation (Clemons, & Chen 2011). Zissis & Lekkas (2011) describe the risk associated with the cloud based in e-government as tangible and intangible. Tangible risk arises from the infrastructure required for cloud, availability of service and integrity and intangible risks are associated with reliability of the cloud, confidentiality and privacy of data and information, security mechanism and quality of service.

i. *Privacy and security*

Data security and privacy of information is the primary concern in the cloud-based computing (Clemon & Chen 2011). Paquette et al., (2010) says when there are not much choices and lack of standardization of the policies about the use of cloud it causes much serious problem for its use in government. One of the most obvious reason for the developing countries to move towards cloud-based e-government is to save cost (Liang, 2012, Khstree 2010), that is required for setting up the huge ICT infrastructure and it could only be achieved by using third party cloud or public cloud. While making use of the public cloud offers the greatest cost savings, this isn't always an option in the public sector, where security and privacy are of paramount importance (Microsoft, 2014). Using third party cloud means uploading the databases to the storage facility provided by the cloud service provider, who has higher priority to access the data. Since data are exposed to a third party, several security threats may occur (Smitha et al., 2012). Clemon & Chen (2011) says while private organizations have shown concern on the unsolved problems in implementing secure cloud, it is matter of grave concern for the governments to shift toward cloud based electronic government because of the greater risk of identity theft.

For example, in 2010 WikiLeaks had revelled thousands of confidential documents of USA government. As the documents were strictly confidential, the leaked information had brought serious consequences on the relation between the USA and some other countries. As a result, Brazil has asked mail service providers to move their mail servers within country or will face ban in their services. Brazil has also started to build their

own mail server for the official use to avoid the intervention of an intruder. Similarly, a report published by The Hindu newspaper in October 2013, US national security Agency (NSA) has collected more than 6.3 billion pieces of information from India's computer and telephone networks over the course of a month as a result India has imposed a ban on the use of foreign cloud-based email services to send official communications.

Thus, it is very important to consider how much risk a government would bare while shifting to the cloud. To minimise those risks Paguette et al., (2010) emphasise on the placing the risk management plan for the electronic government projects before shifting to the cloud computing.

ii. Availability

Unlike the private organization, governments have much more responsibilities towards their citizen. Through e-government, governments are committed to provide their citizen seamless and continuous service thus they need to relate to its citizen and business at all time (Lee et al., 2005). The concept of e-government is based on anytime and anywhere service, that could be achieved when there is effective and reliable system in place. While availability is known as an important characteristic of the cloud-based computing, the dependencies on the internet could make availability its constraints (Jansen, 2011). Effective use of cloud computing depends on access to high-speed Internet. In the event of loss of internet connection and poor network the cloud-based service would not work effectively or would not work at all causing frustration to the user and loss of time and money (Low et al., 2011). In particular internet connectivity and speed vary according to the different geographical location in developing countries, for example metropolitan cities have more reliable and high-speed connectivity whereas rural areas have poor, as cloud computing demand high speed internet this uneven access to broadband makes the cloud services uncertain (Khare et al., 2012). As the government promises to provide 24x7 and 360 days a year service to the citizen through e-government the volatile nature of the cloud service could cause significant risk of losing public trust (Hashemi et al., 2013).

iii. Reliability:

As there are only a handful of choices in the market it is always a question of concern, are the cloud platforms reliable to totally depend upon (Khshtree, 2010). There were several incidents of outage of the cloud services in the past. The worst outage of the cloud is considered as the Amzon's Elastic Compute Cloud (EC2) outage in February 2011 which has caused enormous loss of data and money (Armbrust et al., 2010). According to the GeekWire, a technology news portal, Amazon lost more than \$4.8M after going down for 40 minutes.

The most recent, application as service outage occurred on 3 December 2015 while Microsoft office 365 cloud has gone down restricting thousands of the users in the Europe and UK from accessing the emails and use the office 365 cloud that last about four hours. Speaking about the outage of cloud 365, Cloud email management firm Mimecast's cyber security specialist, Orlando Scott-Cowley, advised that those in the public sector, should not "put all [its] eggs in one basket" when choosing a cloud service (Gothard, 2015). However, for developing countries, those are taking initiative to shift to the cloud-based e-government for saving cost, taking services from more than one cloud provider is not justifiable. Jaeger et al., (2008) and Abu-Libdeh et al., (2010) describe cloud outage as serious problem that could cause great damage to government system. Cloud outage for the cloud-based e-government means, no more access to the government services for the users, no more interactions in between business to government and within the government department that could bring a country to a halt (Kshetri 2010 and Paquette 2010). Losing user and crucial government data permanently couldn't be compensated in any way.

iv. *Information blocked*

Wilson et al., (2010) raise a question about outsourcing management of national trust and documents of national interest to a private corporation. Stored data and information of a country is most important asset and blockade to them can cause serious problem. In case of national conflicts between two countries, one can pose information blocked to another country resulting to the total failure of the e-government system of a country. not only the service will unavailable there is great risk of losing the data and information and risk of losing the confidential information of a national interest.

v. *Interoperability*

Ability to transfer data and information from one cloud to another is referred as an interoperability. As the cloud computing is still in development stage there is lack of industry-wide cloud standards (Lewis, 2013). Government's needs are often changed, and the real problem starts when the governments wants to change the cloud service provider to meet those needs. As the Cloud vendors have built proprietary cloud services on software stacks that are not compatible with the stacks used in public clouds making interoperability difficult(Dowell et al., 2011).This could cause "vendor lock in". The term vendor lock in has been used by (Leavitt 2009,Chow et al., 2009, Armbrust et al., 2010, Dillon et al., 2010, Satzger et al., 2013) to refer to the situation when it's not possible to move data from one cloud provide to another or could be done at huge cost. When there are no more choices, the governments risk to loss data stored in the cloud in case the cloud provider goes out from the business. Moreover, the vendor lock in situation reduce the government negotiation power with the vendor causing the expensive cloud service.

2.7. ChapterSummary

The chapter a brief discussion in the existing literature in the subject domain. The focus of the chapter is to develop an understanding on the issues that the e-government projects have been facing in the developing countries. The chapter has discussed the sustainability from the different perspectives, i.e. design reality gap, e-government approach and e-government maturity model. The discussion has also covered an alternative effort made in the past year to design sustainable e-government services by employing cloud computing platform and the issues faced while adopting cloud computing in e-government. In summary, the discussion has contributed in identifying the gap in the knowledge and motivation for the research.

The aim of this chapter is to develop a background for sustainability-driven e-government maturity model (SDEGM) that supports the design and implementation of sustainable e-government service in the context of the developing countries. The maturity model is developed by synthesising the exiting e-government maturity models and by including different determinants of the sustainable e-government services.

The chapter starts with the introduction of the sustainable e-government services and sustainability-driven e-government maturity model. The introduction is followed by the determinants of the sustainability-driven e-government maturity model, where different determinants will be discussed those impact the design of sustainable e-government services. The last section of the chapter introduces the sustainability-driven e-government maturity model. The proposed maturity model considers two different dimensions, i.e. implementation and adoption to deliver sustainable e-government services. The dimension, stages and activities of the maturity model are briefly discussed in this section.

3.1. Introduction

Governments in the developing countries are facing enormous pressure to design sustainable e-government services (Janssen & Estevez, 2013). The sustainable e-government services should be capable of supporting governments to achieve their goals and provide operational simplicity (Lin et al., 2011). Furthermore, the sustainable e-government services should be able to provide a value for investments in terms of, quality of services, wider acceptance and adoption of the offered services, cost of e-government implementation, and operational efficiency (Rowley, 2011). Moreover, the increased Lifespan of the e-government services and the flexibility of brining changes in the technology when required are also some of the key characteristics of the sustainable e-government (Curry & Donnellan 2012). *We define sustainable e-government as the ability of citizen centric trustworthy e-government services that adopts state of the art technology for a cost saving, resilient, and effective service delivery and supports active participation and satisfaction from all user level.* E-government maturity models plays crucial role in designing sustainable e-government services which provides an appropriate strategic plan to execute the e-government projects (Almarabeh & AbuAli, 2010). A well-designed and well-assessed plan would provide a better understanding of the strengths and limitations of the governments, allowing the selection of the best possible approach to e-government project assimilation for its sustainability (Aichholzer, 2004).

3.2. Determinants of the Sustainability-driven e-government maturity model

Based on the limitations of existing e-government maturity models, we have identified a few determinants those must be incorporated into the sustainability-driven e-government maturity model (SDEGM) to support governments in delivering sustainable e-government services. Figure 3.1 shows how inclusion of the determinants contributes in designing a viable e-government maturity model that supports governments in achieving sustainability.

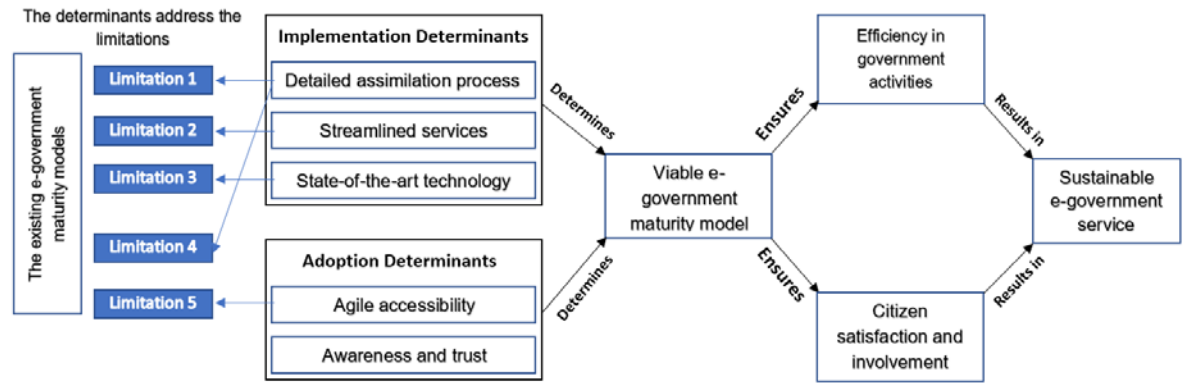


Figure 3.1: Determinants of the sustainability-driven e-government maturity model

The determinants have been defined from both implementation and adoption perspectives. Each determinant attempt to address one or more limitations those exit in the exiting maturity models.

3.2.1. Implementation Determinants

The implementation determinants of e-government maturity model ensure that they deliver the best possible approach for e-government implementation by providing clearly-defined stages, and the activities required to achieve those stages. The implementation determinants mainly focus on how governments could achieve streamlined e-government services in developing countries. The following implementation determinants are proposed for a viable e-government maturity model that results in sustainable e-government services.

Determinant 1: A detailed assimilation process is desirable for a viable e-government maturity model.

E-government maturity models should be able to provide a detailed outline of processes required to achieve the stages of e-government assimilation. A lack of detailed processes often brings confusion when initiating a stage, as there is no explanation of how each stage will be accomplished (Shareef *et al.*, 2011). Existing maturity models failed to provide the activities required to achieve maturity stages of the e-government assimilation (Shahkooh *et al.*, 2008). Therefore, the inclusion of detailed assimilation activities would contribute toward a viable e-government maturity model.

Determinant 2: E-government maturity models should support governments in designing streamlined services.

A sustainable e-government requires government services to be more citizen-centric and streamlined (Napitupulu & Sensuse, 2014). Disparate e-government systems and individual databases discourage users from adopting the offered services as they result in incomplete service and may require secondary action, such as visiting government offices to complete service requests (Rana *et al.*, 2015). Furthermore, individual and disparate electronic government systems are becoming financially less sustainable for developing countries, as their maintenance demands excessive budgets, and replicates government processes (Rowle, 2011). Unless these systems become centralized or connected, government officials must process service requests manually, resulting in inefficiency and lower productivity (Curry & Donnellan, 2012). Therefore, a sustainable maturity model should be able to support the government in delivering streamlined services through the integration of a government system.

Determinant 3: E-government maturity model should emphasize using state-of-the-art technology.

Technological models and frameworks need to be frequently updated to accommodate the most recent changes in technology (Supriyanto & Mustofa, 2016). To ensure and remain competitive, technological projects (i.e., e-governments) need to adopt state-of-the-art technology (Almarabeh & AbuAli, 2010). Most of the maturity models were developed quite a few years ago, therefore, lack the strategy to make e-government projects more efficient through the adoption of recent technology (Lee, 2010). We emphasize the use of cloud-computing platforms for e-government services. While traditional technologies are becoming financially less affordable to maintain and operate, and more complex, we stress that governments should adopt more sophisticated and recent technology when it comes to extending e-government services in developing countries.

3.2.2. Adoption Determinants

Adoption of electronic governments is as equally important as the electronic government itself to become successful (Coursey & Norris, 2008). Adoption of e-governments refers to the active participation of citizens in e-government activities. Therefore, e-government maturity models should also provide a strategy to gain maturity from an adoption perspective (Joshi & Islam 2018). The adoption of e-government services and user involvement depends on several determinants, such as

accessibility of the services, trust, awareness, and ease of use. Therefore, these determinants need to be appropriately addressed when designing e-government maturity models.

Determinant 4: E-government maturity models should support the government in identifying agile accessibility to the service.

Accessibility of e-government services is strongly related to its success. Agile accessibility ensures that the offered services can be used by the widest possible range of people, in terms of their abilities. Specifically, while developing countries are facing a huge challenge from a digital divide among citizens, governments must make sure all the citizens can equally enjoy the e-government services. Riggins & Dewan(2005) have found that specific group of people, i.e. disable, old and poor in a society are lagging from getting benefits of e-government services in developing countries. These include people on low incomes, people with few educational qualifications or a low literacy level, the unemployed, elderly people, people in isolated or rural areas, and people with disabilities, women, and girls (Cullen, 2001). Lack of access to the computers and internet further restrain them from adopting e-government services. Therefore, sustainable e-government maturity models should support governments in determining various channels of e-government service delivery.

Determinant 5: E-government maturity models should be able to support governments in developing awareness and trust among citizens.

The proposed maturity model strongly emphasis on building awareness and trust among citizens for sustainable e-government services. Thus, citizen trust is considered as an important catalyst of e-government adoption (Warkentin et al., 2002). Lack of awareness about the benefits of e-governments remains a critical factor in user adoption in developing countries. Many factors, such as education, race, and culture have contributed toward a low level of user awareness (Shareef *et al.*, 2011). It also came to our attention that some clusters of society (i.e., women, people considered of a lower caste, and people under the poverty line) had considerably lower awareness about e-governments. Meanwhile, Hollenstein (2004) highlighted that building trust among citizens toward e-government services was most essential for e-government success. Users need to be assured of the legitimacy and authenticity of e-government services, and that personal details processed online are secured with confidentiality remaining

intact. Therefore, to increase user participation and to make e-government services accessible to the isolated clusters of society, governments should work on building awareness and capacity.

3.3. An overview of the proposed approach

The proposed sustainability-driven e-government maturity model (SDEGM) incorporates the determinants mentioned in the previous section for delivery of the sustainable e-government services in the context of the developing countries. The implementation determinant; detailed assimilation process, is addressed by providing detailed activities in each stage, and by defining how these activities will contribute toward achieving maturity of those stages. The subsequent determinants, streamlined services and the use of state-of-the-art technology, are addressed by placing the integration stage before the transaction stage, as seen in Figure 3.2. The integration stage defined how state-of-the-art technology could be used to integrate isolated e-government systems to deliver streamlined services. Furthermore, the adoption determinants (agile accessibility, trust, and awareness) are accommodated in the adoption stages. The adoption stages of the proposed model define various channels of e-government service delivery that supported agile accessibility. Moreover, the activities under the adoption stages provide detailed explanations on how governments could increase trust and awareness to acquire wider participation from users. One of the key differences between the proposed model and existing models (Layne and Lee, UN, Gartner, Reddick) is the inclusion of adoption stages for e-government services sustainability from adoption perspectives.

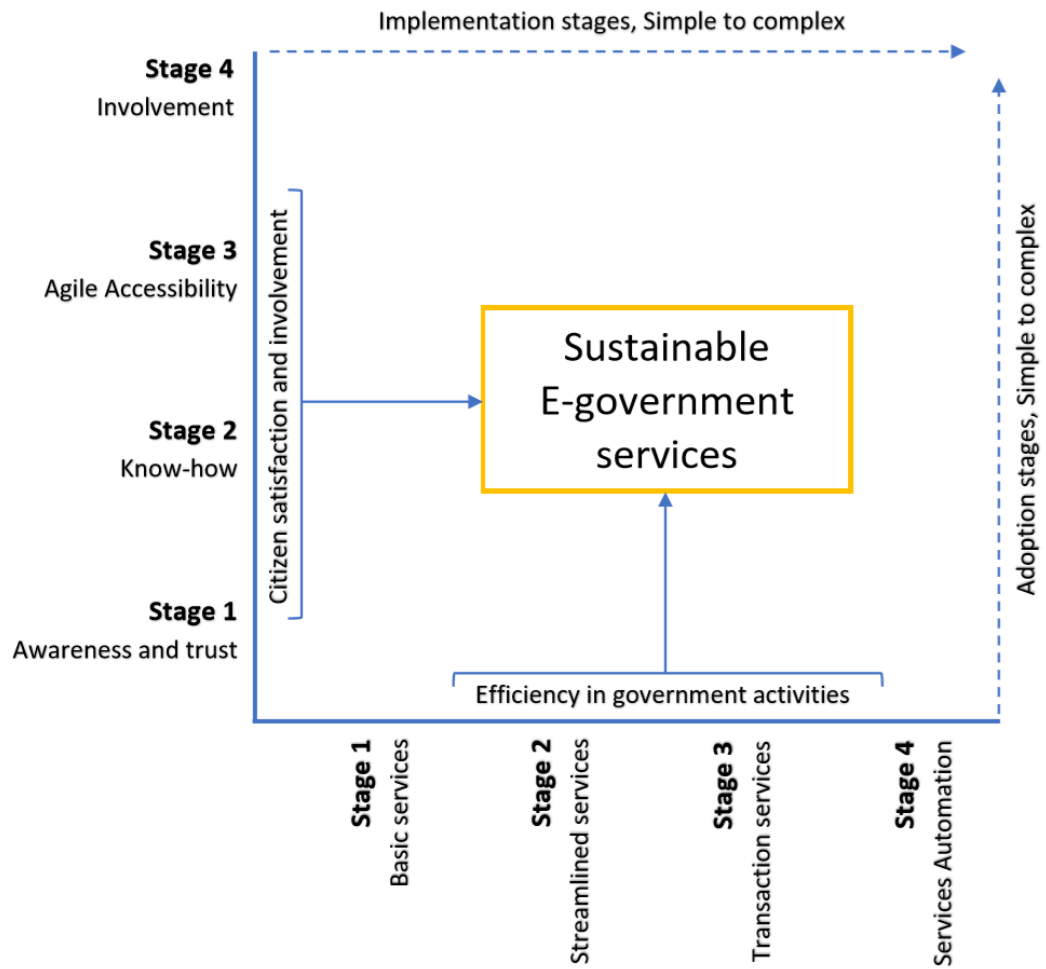


Figure 3.2. E-government maturity model for sustainable e-government services.

3.3.1. Implementation Perspectives

This model considered four implementation stages and emphasis that the integration of e-government systems should be done before invoking the transaction stage. The stages and the requirement to achieve those stages were identified and are discussed below to provide a detailed plan for e-government implementation.

Stage 1: Basic Services

The initial stage proposed by the maturity model is to introduce basic e-government services. Unlike existing e-government maturity models, the proposed model emphasis on using social media tools and establishing a web presence to communicate with stakeholders. Use of social media (i.e., Facebook, Twitter, YouTube, LinkedIn, etc.) is great approach to reach out to masses of people. This stage explains how governments could gain trust from citizens by addressing their queries through a web presence. Furthermore, this stage supports governments to develop awareness among stakeholders

in relation to e-government services. The following are the requirement defined by the model to achieve the basic services stage.

Requirement 1: Computerization of the government departments

The first requirement to achieve the initial stage of e-government implementation is to computerize government departments. Governments are to provide appropriate training to their employees to operate computers and basic computer applications used in government offices. Along with computers, other hardware devices, such as printers, scanners, and storage devices are also to be installed. Government departments and offices are also to connect to the internet.

Requirement 2: Information cataloging and online presence

Once governments have computerized their departments, they are to start cataloguing data they hold in paper format. Governments are to then transfer hardcopies of the data held by government offices into a digital format. Along with the cataloguing of information, governments are to start developing websites and using social media tools to make online presence. Social media, such as Facebook, Twitter, YouTube, and LinkedIn are suggested as effective approaches to reaching an increased number of stakeholders.

Stage 2: Streamlined Services

The sustainability-driven e-government maturity model (SDEGM) emphasis on streamlining e-government services for their sustainability. Streamlined services are defined as complete and integrated services, where stakeholders could acquire government services without having to visit government offices. This requires the integration of e-government systems held in the various government departments. Integration must be done along with the establishment of the electronic government infrastructure to save government resources, and to avoid the risk of data replication, as shown in Figure 3.3. Without vertical integration, governments could end up with several individual and isolated electronic government applications and data repositories. Vertical integration interconnects government departments those share similar interests to avoid data replication, and to enhance service delivery. Furthermore, streamlined government services removes manual data processing layers that exist among the government departments. This has high implications in the context of developing

countries, where citizens have poor access to ICT tools, integrated databases, and authentication systems would allow local government officials to better serve the citizen. Therefore, the proposed model brings integration stage before moving to the transaction stage.

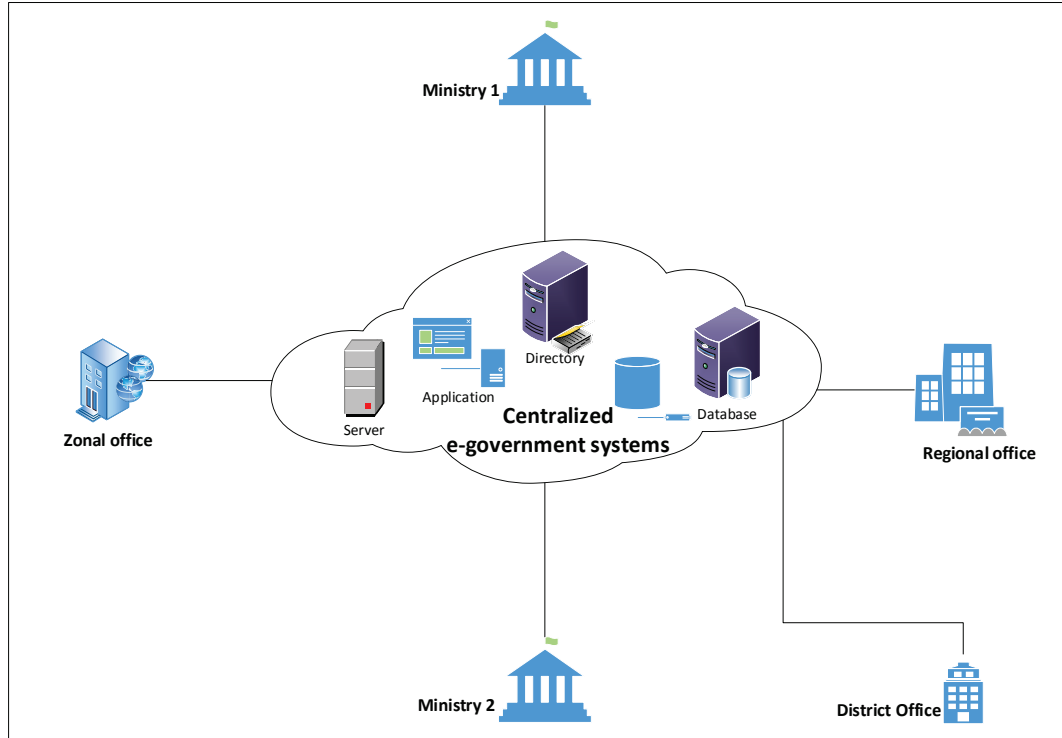


Figure 3.3: Integrated e-government system for streamlined e-government services.

To achieve the streamlined services, the following requirement should be met.

Requirement: Networking and connectivity

The first requirement towards achieving streamlined e-government services is the establishment of reliable and effective networking and connectivity. The government must establish interconnection between government departments and build effective networking for reliable connectivity. Governments require to establish wired (fiber-optic or cable) and wireless connectivity to achieve this interconnection. An interoperability framework need to be developed allowing systems in various government departments to communicate effectively. It would be challenging for developing countries to achieve interconnectivity as it would require an excellent and reliable networking infrastructure. Therefore, developing countries could consider cloud-based integration as a potential solution of e-government system integration at various levels without the need of a physical networking infrastructure.

Stage 3: Transaction Services

Unlike the other (Layne & Lee, Gartner, UN) maturity model the sustainability-driven e-government maturity model (SDEGM) places the transaction service at third stage of maturity. The proposed model argues that, without achieving integration, transactional services cannot be delivered efficiently. The transaction services offer the citizen to complete financial transaction online. More broadly transaction service comprehends the streamlined services by validating the transaction. The integration of government departments and e-government services allows government departments to communicate in real time, avoiding any delays in the transaction services. At this stage, governments establish a payment gateway, allowing stakeholders to acquire services online, and would also establish an effective communication mechanism, allowing governments to become more interactive. The requirement for achieving the transactional stage are discussed below.

Requirement 1: Government legislations for electronic data processing

Governments are to introduce legislations and regulations in relation to electronic data processing and the validity of electronic transactions to make electronic transactions legitimate and to build trust among stakeholders.

Requirement 2: Establish a verification mechanism

To provide real-time e-government services, governments need to have mechanisms in place verifying data and identities of users. Verification could be fully automated, or in complex cases manually processed. User identity documents (IDs), voter IDs, driving licenses, or passports could be used for identity verification.

Requirement 3: Establish a payment gateway

Payment gateway is most important requirement for achieving the transaction stage. It is imperative to have payment processing method within the e-government system for fully functional e-government services. Governments in developing countries could adopt private business partnerships for payment processing and could integrate online banking or mobile banking for government services so that users could make financial transactions. Once governments have established online documents, transaction verification services, and payment gateways, they are to offer the services online.

Stage 4: Automated Services (One-Stop Shops and E-Democracy)

Automation is the fully mature state of e-governments where users are proactively involved in government activities. In this stage, government services are transformed from a push to a pull (demand-driven) format. E-government services also become smarter, synchronize with user accounts, and provide automated services, such as text reminders regarding unpaid bills, license and ID renewals, etc. The following requirements are identified to achieve automated service stage.

Requirement 1: High-level integration

Governments are to establish high-level integration where departments are vertically (same department at various levels) and horizontally (various departments at various levels) integrated. All government departments are to share data, avoiding any middle layers, making the system smarter.

Requirement 2: One-stop shop

Governments are to develop single-window government portals, allowing stakeholders to access all available government services from one place. Governments are to provide unique IDs to registered users, which are to be used to access all e-government services.

Requirement 3: Synchronization

Governments are to synchronize user data with government systems to provide tailored services to stakeholders. User accounts are to be synchronized with calendars to provide important dates that users are to act on (e.g., permit renewals, tax payments, social security payments, etc.).

3.3.2. Adoption Perspectives

The proposed model identified four adoption stages where stakeholders were to have gradually experienced electronic government services and been proactively involved in e-government activities. The adoption side was more focused on human and organizational issues. The adoption stages emphasized the creation of value for stakeholders at each stage of e-government implementation. The proposed maturity model integrated the adoption stages within the implementation stages, to better guide governments toward developing combined strategies to achieve citizen satisfaction, along with efficiency in the implementation of e-government services. The stages have been discussed below in brief.

Stage 1: Awareness and trust

This stage is to go along with the introduction stage of e-government implementation. Stakeholders are to be prepared for changes that take place in the delivery of government services, and channels of interaction. Along with awareness and training, governments are to put their efforts into making stakeholders ready for the change. Governments have the responsibility of developing the skill and expertise of government employees, and of educating stakeholders about e-government initiatives.

Stage 2: Know-how

Know-how refers to the practical knowledge of how to adopt the offered e-government services. As governments start providing streamlined services, the knowledge of stakeholders is to be enhanced for them to get involved in e-government activities. Stakeholders are to be provided with appropriate training through workshops, seminars, television programs, and other means of communication to enhance their knowledge in relation to the benefits of electronic government services, and how these services are to be achieved.

Stage 3: Agile accessibility

This stage is to go along with the integration and transaction stages of implementation. Various factors, such as access to technology, personal circumstances, social influence, availability of service, reliability of service, security, and trust will affect users' decisions to adopt or discard the online services. Among these factors, access to technology is the most critical in relation to developing countries. Therefore, the proposed model emphasized on establishing various e-government service delivery channels for agile accessibility to e-government services. Agile accessibility to e-government services could be achieved by developing various channels to deliver services (e.g., tele-centers, kiosks, private business partnerships, and rural municipalities). Especially in the context of developing countries, where the digital divide among people is apparent, agile accessibility will make sure that stakeholders with various levels of ability will have an equal chance to acquire e-government services.

Stage 4: Involve

The maturity stage of user adoption of electronic governments was described by the involvement of stakeholders in government decision-making. At this stage, stakeholders would have the chance to have their say in government activities and could actively participate in government policy making process. Governments could acquire the view of stakeholders from various channels, such as online consultations, live chats, public polls, etc.

3.4. Chapter Summary

The chapter presented a new maturity model that has been developed by accommodating the determinants of the sustainability-driven e-government services. The model has both implementation and adoption stages which is required by the sustainable e-government services. The chapter discusses in detail the necessity of the sustainability-driven e-government model, its determinants and how they impact on designing sustainable e-government services. The proposed maturity model defines stages and activities required to achieve the sustainable e-government services from the perspectives of developing countries. Finally, the model defines the e-government approach and technology approach the governments needs to adopt.

The aim of this chapter is to conceptualize the sustainability-driven e-government model implementation approach. The model is shaped by rigorous discussion on the domain problem, limitation of the exiting e-government maturity model and the determinants of sustainable e-government services.

The chapter is divided in to two sections. First section briefly describes the conceptsrequired for the sustainability-driven e-government model implementation. The components of the conceptual model have been identified from the preliminary investigation. The second section delivers the detailed discussion on the model assimilation processes. The chapter ends with the brief discussion on the framework and Summary of the chapter.

4. Introduction

The previous chapter presented an e-government maturity model that comprise both implementation and adoption stages. The model includes determinants of the sustainability-driven e-government services, and briefly discusses the maturity stages from the sustainability perspectives. The maturity model serves as a strategic framework while designing sustainability-driven e-government services. This chapter presents, the concepts, and activities required for implementing sustainable e-government services.

4.1. Framing the concepts

The sustainability-driven e-government model implementation approach consists of seven concepts those are interrelated to support the governments, from initializing the e-government to execute and monitor the project. The defined concepts are arranged into the different stages along with the relevant activities and elaborated in detail to form a conceptual model.

Vision: Government vision is a core concept of the sustainability-driven e-government model. Government visions for the electronic government are directed towards the betterment of the government services and to acquire wider participation from the stakeholders. The vision for the sustainability-driven e-government model is to support the governments in the developing countries to deliver e-government services in efficient and effective manner by using ICT infrastructure to support the citizen's need. The vision remains constant in the all the context while using the proposed framework.

Goals: The concept goals are defined by the concept vision. The generic goal of adopting e-government is to transform government services to gain optimum value from the government resources. However, the sustainability-driven e-government model has two specific goals, consist of both technological and organisational aspects, which supports the governments to achieve their vision.

- *Technological Goal:*

The technological goal for the proposed model is to identify an appropriate technological solution to address inadequate information communication technology that is required to deliver streamlined e-government services in the context of the developing countries.

- *Organisational Goal:*

Organisational goals are directed towards achieving organisation efficiency. As sustainability of the e-government projects is highly influenced by its adoption and efficiency on the government process i.e. cost and time saving, the organisational goals for the model is to achieve citizen-centric e-government services. This is done by aligning the e-government services with the stakeholder's need, by identifying the best possible e-government service delivery approach.

Approach: The concept approach defines the different dimensions of the e-governments implementation. E-government implementation occurs mainly in four dimensions; government to government (G2G), government to citizen (G2C), government to Business (G2B) and government to employee (G2E). The proposed model considers government to government (G2G) approach as relevant in the context of the developing countries. The adopted approach has been justified by reviewing the other approaches and by providing the background of the sustainability-driven e-government maturity model (SDEGM) in chapter 3. The government to government (G2G) approach requires technological support for implementation. For the sustainability-driven e-government, the approach adopts cloud computing platform. This is particularly effective in the context of the developing countries where the ICT infrastructure to implement and integrate the complex e-government services are inadequate. The model identifies the importance of cloud computing in achieving sustainable e-government that provides an integration platform to streamline the e-government service for citizen-centric services delivery. The approach also focusses on the methods of service delivery and electronic transaction processing. It defines how the adopted approach will use different methods to deliver streamlined services.

Strategies: The concept supports the governments to adopt sound strategies to accomplish the goals. Based on the selected approach, we have defined the strategies as technological and organisation. The strategies are developed based on the outcomes received from the different techniques. Requirement analysis and feasibility study will be conducted to design appropriate strategy to implement the proposed model. The strategies for the sustainable e-government are directed towards minimizing e-government implementation cost and time, adopting efficient technology and making the e-government service available for different clusters of the society.

E-government services: The concept e-government services identify and prioritize government services based on their usability and adoptability. Government service automation is one of the priority for the governments (Nica & Potcovaru 2015). Government provides different types of services, i.e. making an application, paying government taxes, submitting tax return, registering berth or death etc. However, transforming all the government services to the e-government at one time would not be viable from both technological and organisational perspectives. Therefore, the concept supports the government to manage and prioritise e-government services based on the e-government requirements. The concept involves identifying and prioritising the government services those are linked with each other to deliver certain services. The identified services are then categorize and prioritize based on their workload and criticality that allows to select appropriate deployment platform. The e-government services are supported by the different delivery channels defined by the e-government maturity model to acquire participation from the user. The implemented e-government services are finally mapped to the framework goal to evaluate their alignment with the government vision.

E-government stakeholders: E-government stakeholders are the entities who use, deliver and develop services for the government. The concept supports the government to assess the different relation among these stakeholders. It identifies the different requirement of the different stakeholders from the e-government perspectives. For example, e-government service user has usability and accessibility requirement and the governments have efficiency, cost saving and customer satisfaction requirements. Therefore, the concept allows government to analyse different requirement of these stakeholder and supports to adopt appropriate strategies, i.e. infrastructure development, awareness development, government policies development etc., to deliver citizen-centric services.

Risks: Risk is the potential consequence which can negatively impact on the overall electronic government implementation. There are different risks associated in the different phase of the sustainability-driven e-government model implementation. The risks could be both technological, those are associated with the technological model selected for implementing the e-government services and organisational those are associated with the government organisation who seeks to implement e-government services. The model adopted cloud computing-based e-government Therefore, the

technological risks are mostly related to the cloud computing. While migrating exiting e-government services to the cloud, a critical challenge remain in many existing information systems are poorly documented detailed documentation on information system architecture and functionality specifications, interfacing, or customizations is often missing and frequently only a small number of experts understand the workings of the system. This could lead to gaps in digital continuity, when quick reactions are required, and these experts are not available. The governments need to adopt appropriate strategy to identify, manage and mitigate the risk. However, all the potential risks are difficult to identify, therefore, a contingency risk management plan should be in place to manage and minimize the risks occurred during and after the framework implementation.

4.2. Conceptual model

The conceptual model integrates all the concepts used for the sustainability-driven e-government services. The concepts form a series of relationship which describes the nature of impact that one concept has on another concept. The concepts may be divided into further sub-concepts at the different stages, while implementing the proposed model. Vision remains at the centre of the concepts that drives the governments to set goals for citizen centric and sustainable e-government services. The concept goal refers to the technological and organisational goals set by the sustainability-driven e-government model. To achieve the goals the government requires e-government implementation approach. The approach defines the dimension of e-government implementation. For sustainable e-government service delivery the model defines government to government (G2G) approach. The approach also decides the delivery channels and electronic transaction processing model to support the selected approach. The approach requires a technological model to materialize. Technological model defines, how different technologies would support the e-government implementation approach. The proposed model has adopted cloud computing platform to implement the selected e-government approach. The technological model comes with risk, those negatively influence the e-government stakeholders from adopting the e-government services while obstructing the concept goal. Therefore, the concept risk deals with risk identification and mitigation process. Figure 4.1 presents the concepts and their relationship.

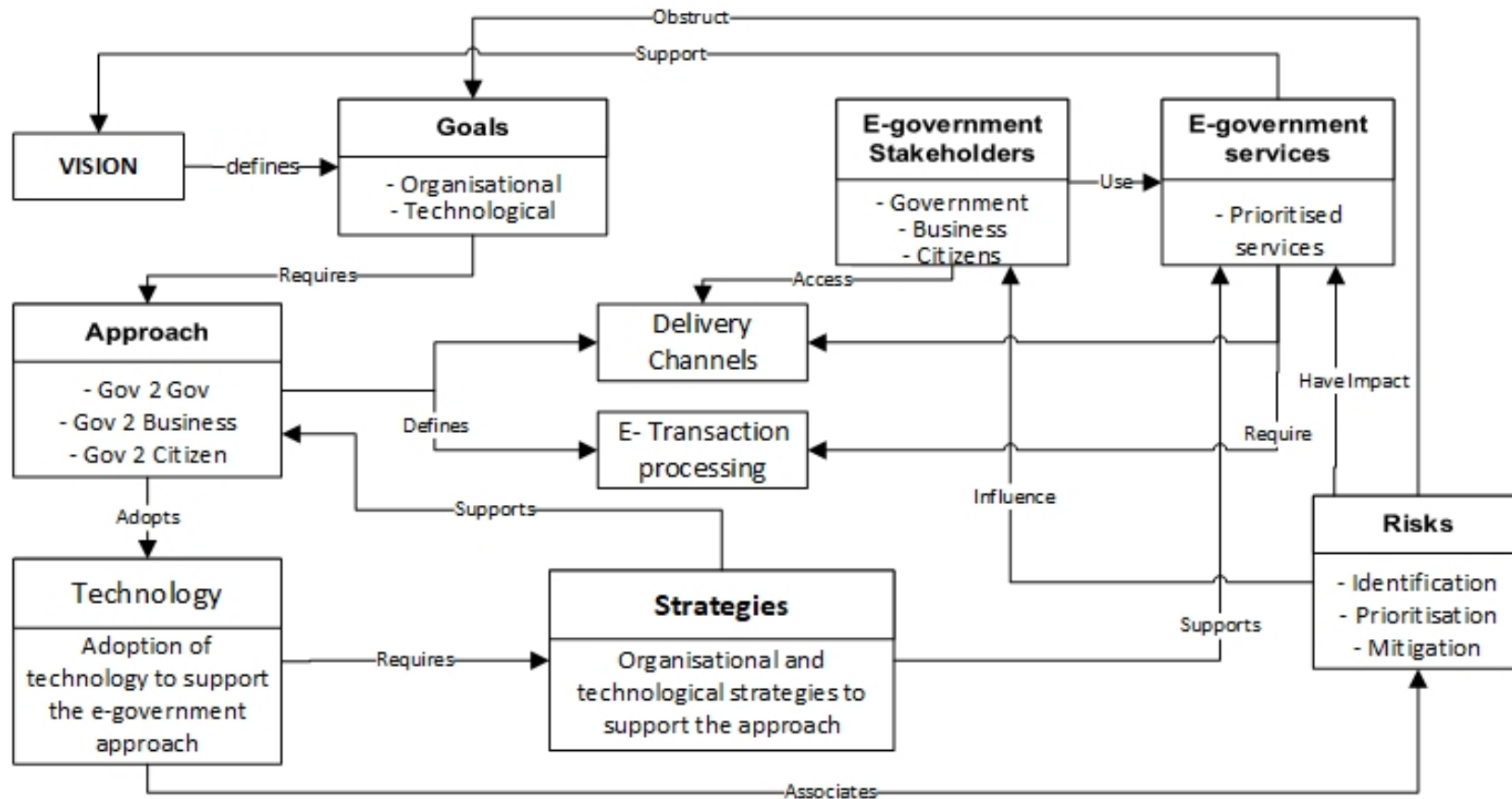


Figure 4.1: Conceptual Model

4.3. Assimilation process

The assimilation process provides a strategic roadmap to initiate and implement the sustainability-driven e-government model that focus on streamlining e-government services for their sustainability. Figure 4.2 presents the sustainability-driven e-government maturity model (SDEGM) assimilation process.

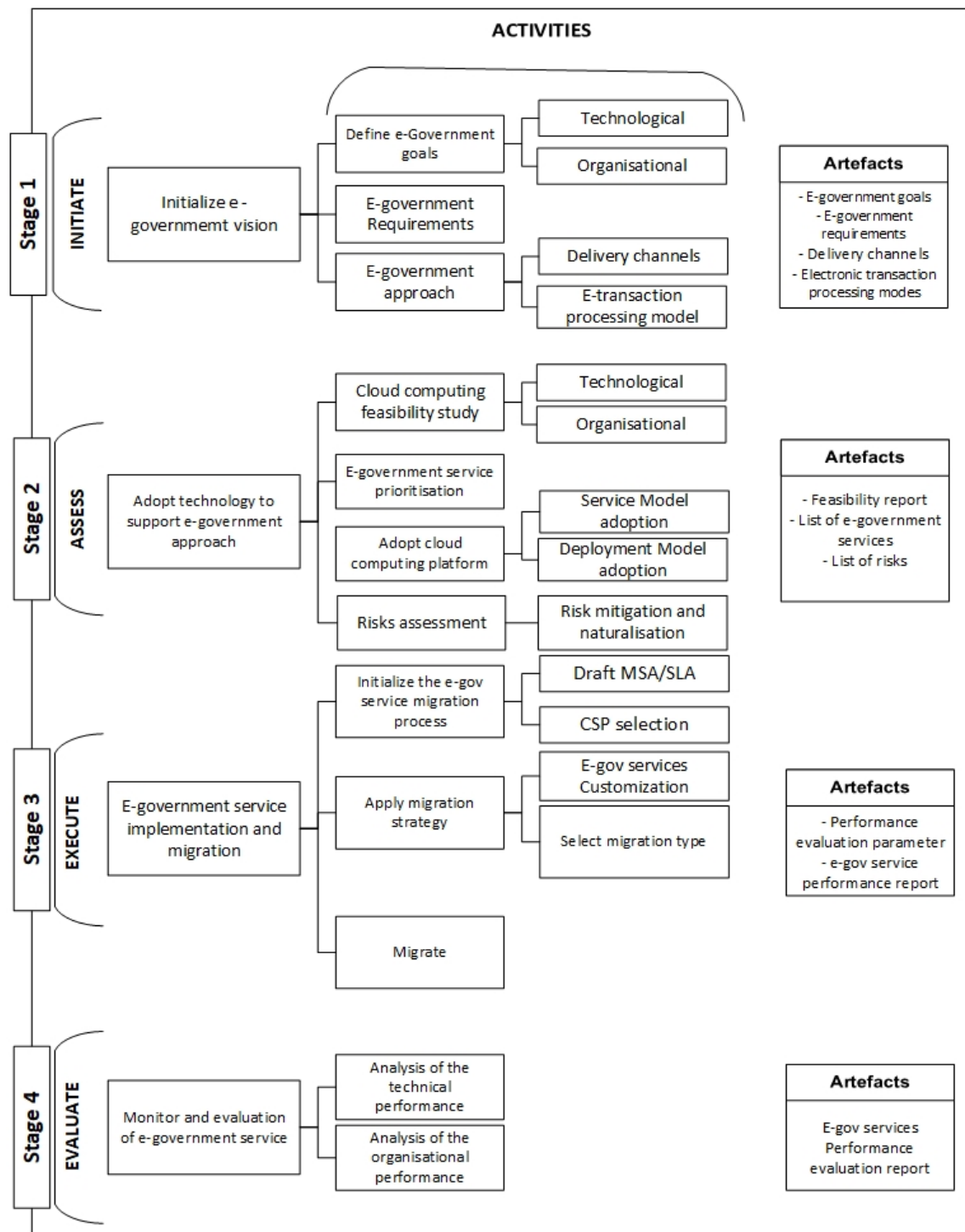


Figure 4.2: Assimilation process

The assimilation process provides an in-depth discussion on the activities those are required to perform to implement the model. The activities use different technique and methods to complete the defined task in stage. The activities are arranged under four different stages; initiate, assess, execute and evaluate and produces artefact in each stage. The stages have been arranged in a linier order, as such a stage needs to be completed before starting a new stage. The artefacts received by completing a phase used as an input for the next phase. The rationales for breaking the model implementation process in the different phases is to simplify the process of managing the projects and minimizing the risks associated with the different activities. The artefacts provide series of outputs, resulted from the activities in any one stage. The following section provides a discussion on the stages and activities defined by the assimilation process.

4.3.1. Stage 1: initiate

Initiate is the first phase that deals with all preliminary studies, i.e. drawing government vision, defining government goals, identifying current e-government practice, government policies and the problems faced by the government while implementing e-government services. The focus of this stage is to apply government vision to define e-government goals for the sustainability. This phase also justifies the adoption of government to government (G2G) approach of e-government implementation for delivering sustainable e-government services. The stage starts with initiating the e-government vision for the proposed model. Government officials responsible to implement the e-government will have brainstorming session with the different stakeholders i.e. government ministries, IT experts, and beneficiaries, to establish government vision for cloud based electronic government. Different interests of the different parties are documented, categorize, and prioritize. Although governments in the different part of the world might have different vision for adopting e-government, the framework supports to achieve governments vision to accomplish citizen centric e-government that could be implemented with the available information communication infrastructure.

Activity 1: Define e-government goals

Once the government vision has been defined, the model requires identification of the e-government goals. The e-government goals for the sustainability-driven e-government

models are directed to achieving the organizational efficiency and citizen-centric e-government services. The e-government goals could be contextual need to be defined at the beginning of model implementation.

Activity 2: Identify e-government requirements to achieve the goal

Government needs certain technological support to achieve the sustainability goals. The exiting e-government practice, available infrastructure and e-government systems needs to be assessed and based on the findings the implementer should decide the technological requirements.

E-government service integration requirement: E-government service integration requirements defines the relationship among the different e-government services and their dependencies on each other to deliver e-government services. The primary objective is to define available integration method, issues the government has faced while integrating e-government system, and technology required for integration.

E-government service delivery requirement: E-government services delivery requirements focus on the e-government service delivery channels. The sustainability-driven e-government model emphasis on the agile accessibility, therefore, different available service delivery channels, i.e. library, Kiosks and other available channels and their potential use in the country context is identified.

Electronic transaction processing requirement: Electronic transaction processing requirement focus on the method that the government could use to process payments online. The requirements asses the exiting electronic transaction processing model used by the government and identifies what other approaches, i.e. private business involvement, e-wallet and other available methods could be incorporated within the e-government services to efficiently and effectively handle the transactions.

Activity 3: Adopt E-government approach

E-government approach defines how the government would supply its services to its citizen. Once the e-government requirements have been identified the third activity is to adopt e-government approach proposed by the sustainability-driven e-government model. The sustainability-driven e-government model adopts government to government (G2G) approach of e-government implementation to achieve sustainability

of the e-government services. Government to government (G2G) approach enables the government departments to collaborate and share data and information among them to provide streamlined government services. The aim of G2G is to enable governments and organizations related to them to more easily work together and to better serve citizens within key lines of business. The goal of G2G is to support e-government initiatives by improving communication, data access and data sharing. G2G initiatives require serious collaborative partnerships and use of technology to do intergovernmental work in new and innovative ways.

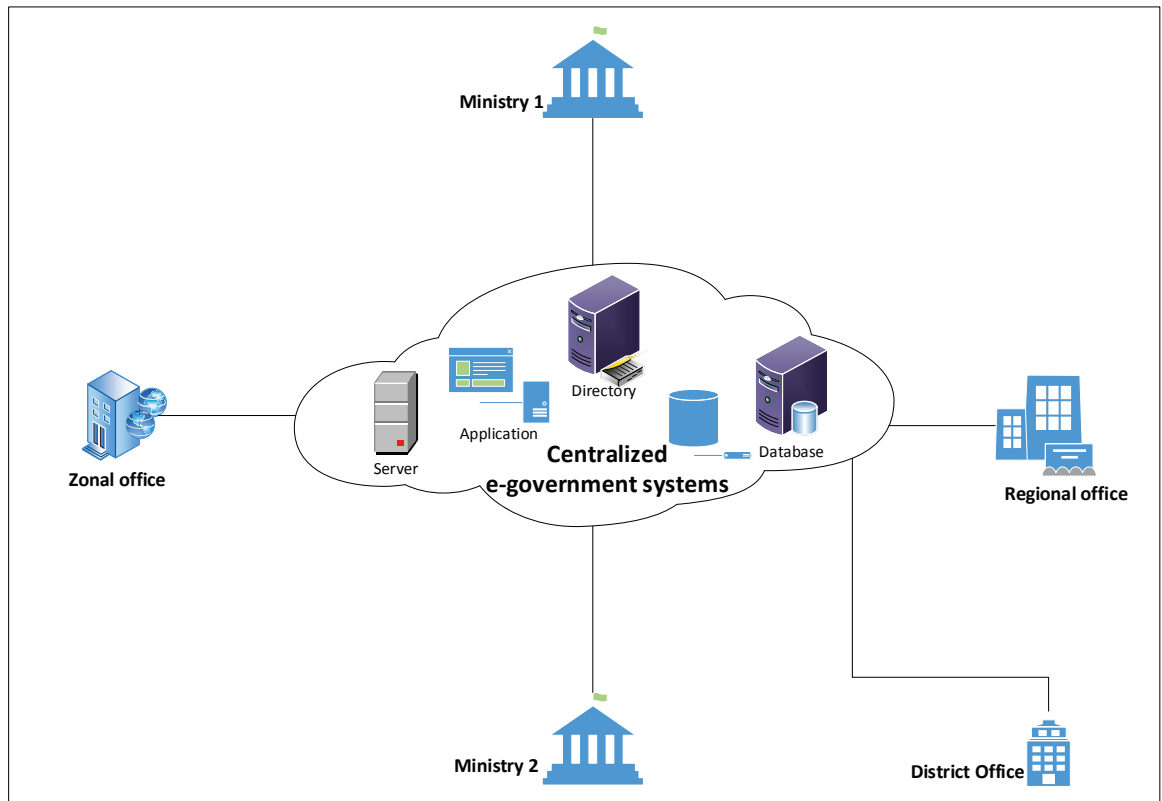


Figure 4.3: G2G approach for streamlined services

While G2G initiatives are usually not apparent to the public, it allows more coordinated intergovernmental connection because of improved information access and greater service efficiency for customers. Developing G2G applications to deliver G2C or G2B services seems to occur when two or more government entities are required to complete a transaction for citizens or businesses. For instance, to process an online application for opening a new company, two or more government entities needed to connect their business processes to allow multiple databases to interact and, in some cases, accept or disburse fees appropriately. Therefore, Integration of the government departments (G2G) for the seamless data and information exchange to deliver streamlined service is

essential. This should be done initially while designing the electronic government. Most of electronic government maturity model (Layne & Lee, 2001, UN, 2005, Moon, 2003) have proposed transaction as the second stage and the integration at the third or fourth stage, in contrast the proposed model brings integration stage before the transaction stage. Integration allows government departments to access the shared pool of data and information that allows government departments to deliver the services to the stakeholders in more efficient and effective manner.

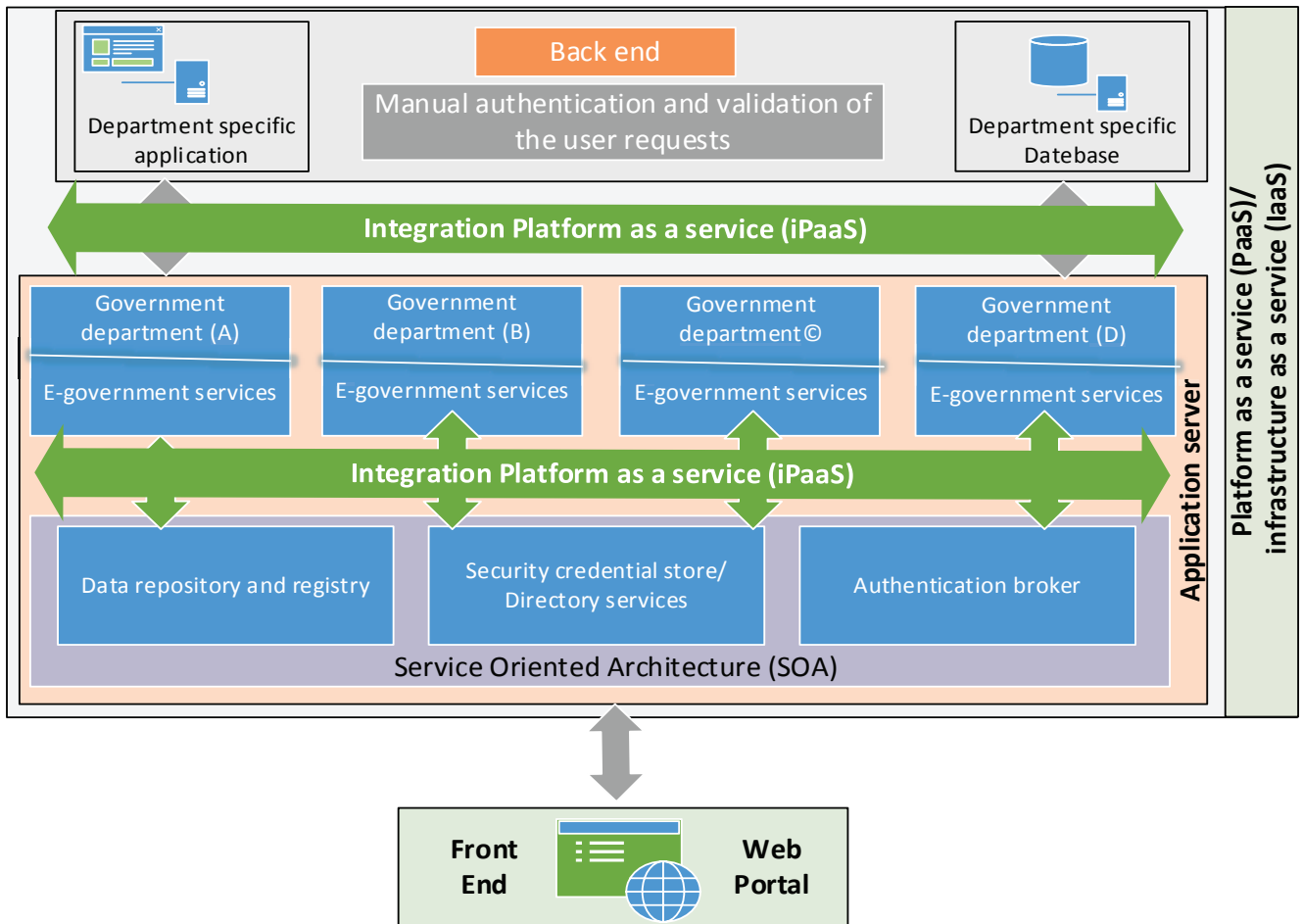


Figure 4.4: Use of IPaaS to achieve the G2G approach

A high-level e-government application and system Integration architecture for streamlining e-government services is presented on figure 4.4. We have proposed integration platform as a service to integrate the e-government application and isolated databases.

Establish the delivery channels

Government needs to establish appropriate Service delivery channels to deliver its e-government services to the various stakeholders. One of the issues that we have found in the current e-government practices is the service delivery approach. Merely building a portal is not enough to gain stakeholders acceptance. As the previous studies have shown that most of the stakeholders in developing countries have limited strength to adopt the electronic government services they still need to visit the government offices in-person to get a service. Therefore, capacity oriented delivery channels, i.e. establishing tele-centres in the remote area where people do not have access to the computer and internet, placing self-service Kiosks in the busy government offices and public places, using local libraries and municipalities to allows people from the different background (Poor, and physically disadvantaged) to use computer and internet for e-government service adoption, need to be established. Based on the existing e-government practices in the different countries, we have found various delivery channels - i.e., Tele-centres, kiosks, private business partnership and rural municipalities are relevant in the context of the developing countries.

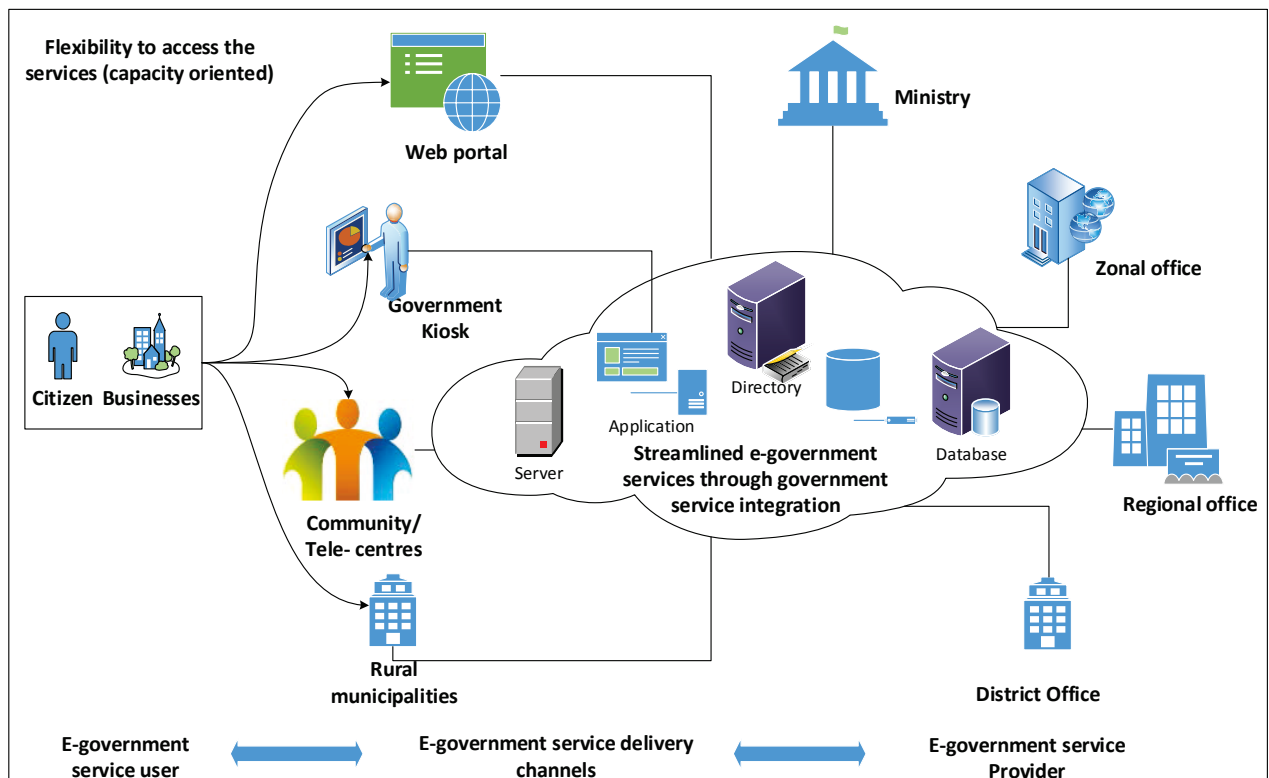


Figure 4.5: Delivery channels for accessing e-government services

Establish Electronic transaction processing Methods

In the absence of the payment gateway, transaction processing modes needs to be identified. It is imperative for the e-government services to have electronic transaction processing modes in place to achieve service automation. These models are based on the available technology in the country context. Based on the current practices that the e-commerce business has been adopting, following could be possible e-transaction processing method for the governments in the developing countries. The proposed methods can be embedded within the government portal to process payments.

Electronic wallet: although developing countries lack payment gateways, many of the countries have private business those are providing electronic wallet services to the users. This could be one of the option for the government to embed their services in the government portal to accept payments.

E-banking: Almost all the corporate banks in developed or developing countries provide e-government services. Government could collaborate with the banks for the payment handling.

Private business: involvement of the private business as an agent to deliver certain government services to the stakeholders could be one of the options for payment handling in developing countries. Government could appoint agent companies to handle the payment sharing certain commission percentage. We have examined various e-government projects in the Asian countries to identify how the financial transaction is being handled. Among them we have found that Pakistan government initiative to engage private business as a franchise to handle money from the stakeholder is running successfully. According to the government portal www.e-sahulat.nadra.gov.pk, e-sahulat handles 23% of the Utility Bill market share with its 12,000 franchises.

Integrated approach for service streamlining

As physical integration of the data and applications is becoming complex and demands more financial and technological resources as the government expand its services and departments, we believe the integration platform as a service would be viable solution to integrate the e-government services. The sustainability-driven e-government model emphasise on using integration Platform as a service (IPaaS) to streamline services from the different government department. Figure 4.6 shows an example of a high-level technological approach for e-government services sustainability. The approach

describes the relationship among the functions and components used for e-government service sustainability. Government department A has been integrated with the government department B through IpaaS. While a user requests a service from department “A” that requires authentication or validation of part of the service request from the department “B”, the IpaaS maintains appropriate connection and communication between those departments and allows to complete the service request. Similarly, the technological approach has defined number potential delivery channels, i.e. Kioks, Tele-centres, rural municipalities, libraries, www web and private business. These channels can be adopted as deemed appropriate in the given country context.

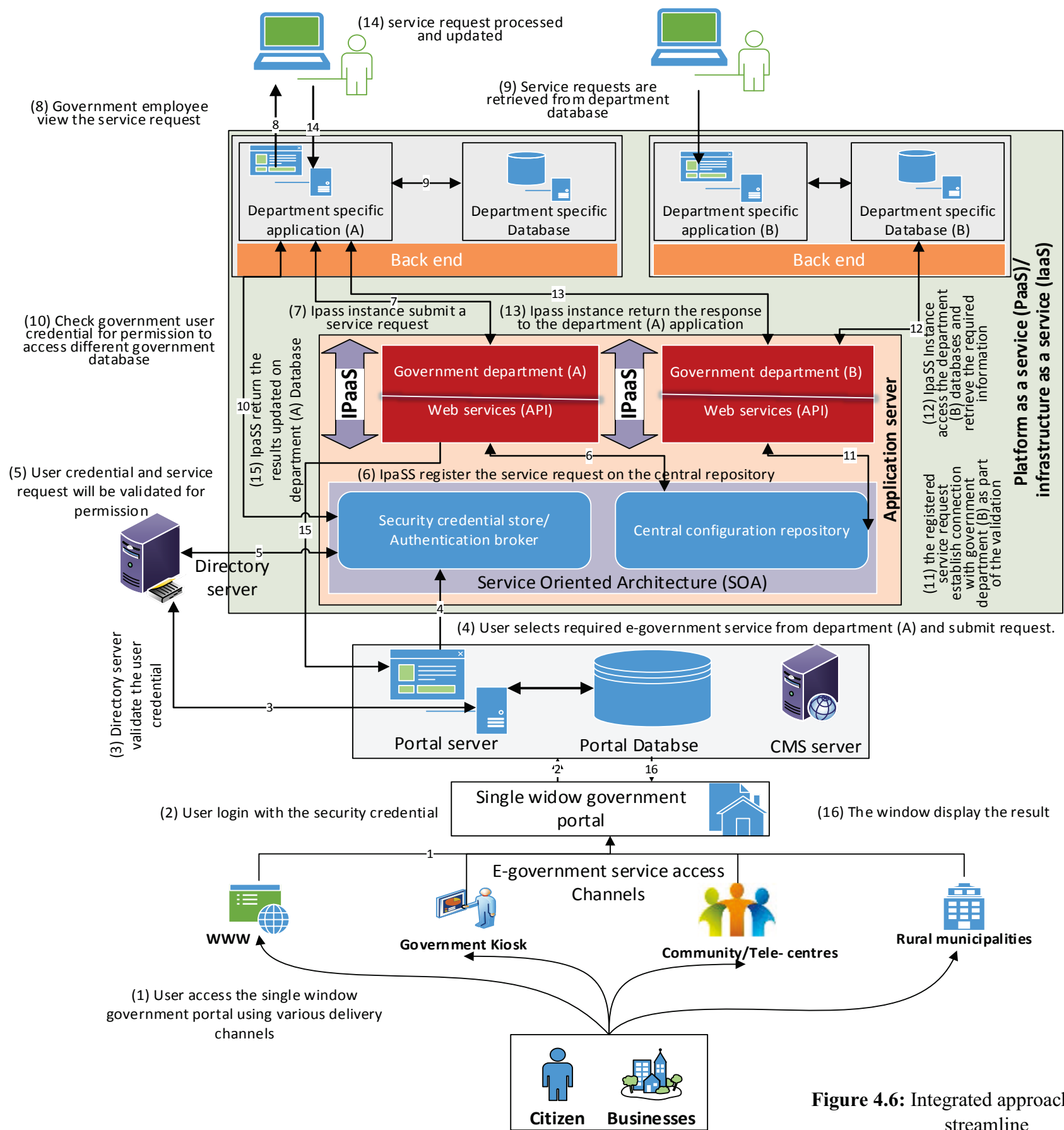


Figure 4.6: Integrated approach for service streamline

Step	Process	Description
1	Service request	E-government services user uses different channels to access a certain e-government services, which requires two department to work together.
2	User login	User logs in with its ID provided by the government and password
3	Validate user	The portal server which is either resides on premise or in the cloud platform match the login credential with the details in the directory server.
4	Selection of service	Once the user logs into the government portal, he/she request for a certain government service, i.e. application for driving licence.
5	Credential check	The service request has been validated with the directory services server to ensure if the user would be allowed to access the service.
6	Register request	Once the traditional have been validated the IpaaS register the request in the central repository.
7	Submit request	The request than submitted to the specific government department for service delivery.
8	Request receive	The government employee in the government department at the backend views the service request in his system.
9	Retrieve the service	The employee retrieves the requested service from the department database.
10	Credential check	The government employee checks the user credential to complete the part of service request that requires accessing the systems of the different department.
11	Establish connection with department B	The IpaaS establish a connection with the department for the service request by using security credential supplied by the department A employee.
12	Access department B for information	The IpaaS instance access the department B database and retrieve the required information as part of the service request validation.
13	Return response	The IpaaS instance return the response to the department A with the requested information
14	Update	The government employee in department A process and update the service request in his system.
15	Return the response	The IpaaS instance return the service response to the government portal
16	User get the notification	The e-government services user gets notification on the progress of the service request.

Table 4.1: Streamlined e-government service through integration

4.3.2. Stage 2: Assess

The second stage begins by adopting technology to support the e-government approach defined by the sustainability-driven e-government model. The proposed approach adopts cloud computing platform for e-government implementation. The approach defines how integration and implementation of the e-government service could be achieved by using cloud commuting platform for the sustainability. The technology being adopted for sustainability-driven e-government model is to supports the inadequate e-government infrastructure in the developing countries for e-government service implementation purpose. Therefore, this stage primarily focuses on the prioritisation of the e-government services, selection of the cloud computing deployment and service model and identification and mitigation of the risks associated with the adopted model. The outcomes of the assessment phase are used to customize the exiting electronic government services if necessary. Once the desired outcome is

(government technically and organisationally ready to adopt cloud-based e-government) achieved the next stage begins, where the existing systems are migrated to the cloud computing platform.

Activity 1: Cloud computing feasibility study

A feasibility study is required to assess the technical and organizational readiness of the government to adopt the cloud-based e-government. After the feasibility study a report will be produced that would show the strength and weakness of the government. The feasibility study will be conducted under two dimensions; technical and organizational.

- *Technological feasibility*

Technological feasibility supports the government to identify the technological strength and weakness of the government for adopting cloud-based e-government. Technological feasibility for the implementation of proposed technological approach is performed by assessing the cloud computing readiness of existing e-government services. Cloud readiness refers to the strength of the existing application and system to perform in the cloud computing environment. Several factors need to be considered while assessing e-government application for their cloud readiness. Dependencies of the existing e-government system and application, the system and application architecture and the workload are the key parameters to assess the cloud readiness of an e-government. Table 4.2 summarizes the attributes for cloud readiness of an existing e-government application or a system. Individual applications are assessed against the given attributes and outcome is recorded as ready, partially ready or not ready. The attributes mainly assess the inter application dependencies, complexity and workload or traffic that can be handled.

Application/ system	Workload (high/low)	Application Architecture	Dependencies (Y/N)	Summary (Ready/not ready/Partially ready)

Table 4.2. Cloud readiness assessment.

- *Organisational Feasibility*

Organizational feasibility supports the government to decide whether the organizational structure is ready to accept the new change. The test measure under this feasibility also

consist the financial feasibility. Financial feasibility supports to make decision, whether the proposed system, is financially feasible for adoption or not. Cost benefit analysis is performed under this activity. Cost benefits analyses compares and weigh the benefits and cost of the framework to determine its feasibility, usability and adoptability of the framework as shown in Figure 4.7. The activity decides whether the adopted technological approach will perform well in the different dimension and meeting the government expectation. Cost benefit analysis determines whether employing cloud based G2G framework is justified in terms of the financial benefit or savings. It compares the information communication technology infrastructure establishment cost with the cost involved using cloud platform for deploying electronic government projects. Having said that, cost benefit analysis is not always discussed in the context of monetary value gain. However, at this stage only, the monetary values are assessed as they can be measured. Monetary dimension involves comparing the cost of framework implementation and operation to the cost with the monetary benefits that the governments have achieved. Non-monetary values involve comparison of the framework cost with the benefits that the government has achieved in terms of customer satisfaction, work efficiency and service delivery time. These intangible values will be evaluated by employing observation and interview method. Therefore, the cloud-based framework evaluates the benefits of the cloud based G2G e-government framework against its cost.

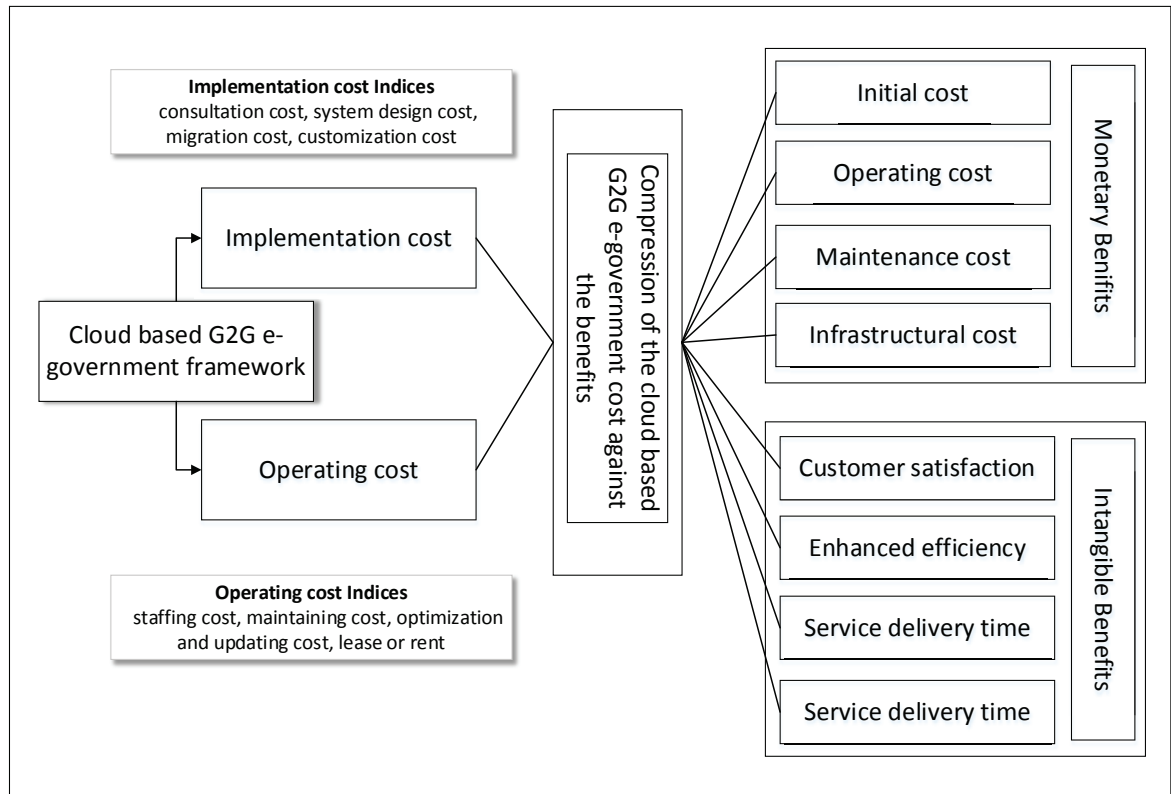


Figure 4.7: Cost benefit analysis

Activity 2: Service Prioritisation

The government prioritizes and selects the services those need to be migrated to the cloud computing platform based on the feasibility report. Prioritisation of the service is crucial to determine the most appropriate services those are both strategically important and yet feasible to migrate. With the strategic imperative in place, government agencies must choose which parts of their IT environment, both legacy and new spending, to migrate to the cloud and, in each case, determine the appropriate cloud service and deployment model. The following parameters should be used while prioritising e-government service to migrate in the cloud computing platform.

- Cost: The parameter weighs the on-premise e-government service running cost with the cost of running the service in cloud
- Impact on business: The parameters deals with the impact on the government process while migrating the service in the cloud.
- Workload: The parameter weighs the workload of the e-government service for its sustainability in cloud

- Compatibility: The parameters assess the compatibility among the different e-government service for the cloud computing platform
- Sophistication: The parameters define how sophisticated the e-government service for the cloud computing migration
- Value for citizen: The parameter assesses which e-government service have most value for the users. Or which e-government service have been mostly used by the citizens.

Activity 3: Adoption of cloud computing service and deployment model

Adoption of the cloud service and deployment model depends on the types of government service and their requirements. Once the government services have been prioritized for migration to the cloud computing platform, they are mapped to the most appropriate cloud service and deployment model.

Selection of cloud computing service model

Cloud computing service model can be selected by considering the nature of the e-government service and its requirement. The Government could adopt different cloud service model according to their needs. We have designed the following decision tree for the governments to decide what service model could be adopted for particular type of e-government system.

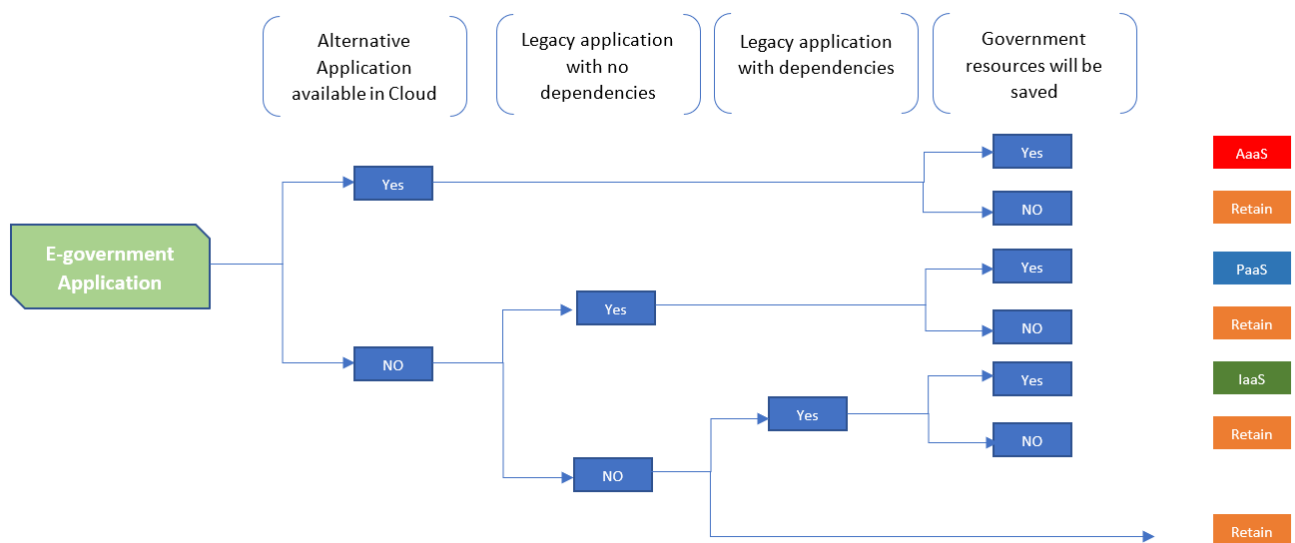


Figure 4.8: Cloud service model adoption decision tree

Selection of cloud computing deployment model

Based on the criticality of the data and information government can select, public, private, community or hybrid cloud. The government must categorize the online services based on their priority and criticality and make appropriate strategy to select the deployment model for the different categories.

Cloud Deployment Selection Model developed by Keung & Kwok (2012) can be used to select appropriate cloud deployment model. We have customized the assessment model that incorporates six deciding factor for government to adopt the cloud deployment model.

1. *Data sensitivity – data significance, data confidentiality*
2. *Availability of the resources: IT skills, time, space, cost*
3. *Predictability of IT demand: Are the e-government system demands predictable?*
4. *Degree of change: Whether the government needs radical change in their system to migrate.*
5. *Strategic importance: Whether the e-government services has strategic importance that needs to be implemented immediately.*
6. *E-government readiness: How sufficient the IT infrastructure is in place. The more advanced level of e-government maturity level of the government would more easily adopt the private cloud, whereas lower level of e-government reediness should utilize the public cloud.*

Deciding Factor	E-Gov sys 1	E-Gov 2	E-Gov ,, n
	Score < 2 (Public cloud recommended) score >2 < 3 (Hybrid), Score > 4 (Private) Based on Likert scale 1 to 5		
Data Sensitivity	x	x	x
Availability of resources	x	x	x
Predictability of IT Demand	x	x	x
Degree of Change	x	x	x
Strategic Importance	x	x	x
E-government readiness	x	x	x
Median Score	x	x	x

Table 4.3: Cloud computing deployment model selection factors

The government is recommended to adopt private cloud if it gets high overall score, in contrast it is recommended to adopt public cloud if the total score is low.

Activity 4: Risk identification and mitigation

This activity aims to identify the potential risks that could obstruct the government vision to achieve for the e-government project so that suitable control can be identified from the early stage. It consists of two steps, risk identification, analysis and control.

Risk identification: This step identifies and categorizes all the possible risks that could have an impact on the cloud-based e-government project. For organisational risks, i.e. business process interruption, long-term viability, and cost consequences could be analysed by using checklist, and interviews. The technological risk contains, data lock in, security breach, unavailability etc. The security related risks associated with the cloud service providers could be identified and assessed by using cloud control matrix (CCM). Once the risks are identified they are categorized into three types.

- Business risks: Such risks can directly oppose the government vision and incur financial loss for the government. It is directly linked with the financial feasibility.
- Organization risks: These risks focus on existing government departments' organizational structure and their suitability for the new cloud-based system. It also focuses on the user perspective.
- Technical risks: These risks consider the technical issues for existing application and their migration into cloud. Furthermore, technical risks also consider the threats relating to security and privacy as they are one of the main concerns for the cloud computing.

Risk analysis and control: Once the risks are identified next step is to determine the severity of the risks so that appropriate control actions can be identified. The risk level is determined based on the probability of the risks and its impact. I.e. $R = P(R) \times I(R)$. We consider three different risk levels. They are: low risks (less than .3), high risk (between 0.3 - .60) and highly critical risk (more than .60). Depending on the severity of the risk we need to choose appropriate risk control strategy such as reduction, prevention, retain, and transfer. At this early stage, it is recommended to prevent or reduce all identified highly critical risks for a successful e-government project.

4.3.3. Stage 3: E-government service implementation and migration

The third stage comprise of the tasks those are required while migrating the existing or new build e-government systems to the cloud computing environment. The execution stage involves different activities those are performed sequentially to migrate the e-government services to the cloud platform. Performing the migration task required the involvement of the cloud vendor or third-party expertise as it involves technical aspects. Many factors such as legacy systems, licenced software, organisational values, application structure, availability of technology and expertise needs to be assessed while the conventional electronic government system is being migrated. The execution strategies are developed based on the attributes acquired from the assessment stage. The execution stage involves developing master level agreement (MLA) and service level agreement (SLA) with the selected cloud service provider that assures the quality of the service. Once the cloud vendor has been selected and the agreements are drafted the government adopts appropriate migration strategy for the selected e-government services. These strategies are developed based on cloud readiness assessment report. Once the cloud computing requirement for the migration is met, the e-government systems will be tested by using different tools available to assess the performance of the applications and e-government system in the cloud. The assessment report will be used to further customize the e-government services and the cloud-computing model if required. Once satisfactory results have been obtained the e-government services are migrated to the cloud computing platform.

Activity 1: Initialize the e-government service migration process

Draft MSA and SLA: Once the government has decided what cloud computing services and deployment model is required for the e-government services selected in the previous stage the migration process can be initiated. The initial task within the migration process is to develop master service agreement (MSA) and service level agreement (SLA). The master service agreement records general government requirement, i.e. cost, help and support, compliance etc. System level agreement is more focused in the technologies aspects, that the government requires from the cloud service provided. The system level agreement details, the responsibility of the cloud service provider in relation to the reliability, system uptime, security, data handling policy, maintenance and disaster management etc. These requirements are recorded as clause in

the MSA and SLA and used in cloud service provider selection and for auditing purpose.

CSP selection: Once the MSA and SLA has been prepared the next task is to select cloud service provider (CSP). The selection criteria are based on the MSA and SLA. Among the short-listed cloud service provider, the MSA and SLA clause are mapped with the services the CSP are offering. CSP that satisfies the maximum number of MSA and SLA clause is selected.

Activity 2: Apply migration strategy

E-government Application and system customization: This task identifies whether there is a necessity of customization of the existing services. The existing legacy system might need a customization before they could be migrated to the cloud environment. Therefore, this task supports governments to assess the selected e-government system to make appropriate customization to gain maximum potential benefit.

Select the migration type: Based on the application and system selected for migration, migration strategy is decided. Parties involve in the migration process, i.e. government official, cloud expert and system developer get involved in deciding which type of migration strategy fit for the selected application and e-government system. The migration types could be one of the following or combination two or more than two strategies.

Re-host (Lift and Shift): E-government applications and software those have been designed from the different compatibility perspectives, can be migrate to cloud by using this strategy. This is one of the fastest cloud migration strategy, where applications are migrated to the cloud without any adjustment or optimisations. Its simplest way and may best serve when large applications require quick migrations.

Re-platform: This is one of the expensive and complex migration strategy, where entire enterprise application is developed in the cloud. E-government legacy software those are coming to end of their life and those are complex to redesign for cloud migration should be re-platformed.

Re-factoring: Re-factoring could be used when legacy applications and software can be optimized new features could be added to achieve greater performance in the cloud

platform. This is the one of the safest approach of migration, as legacy application continuously works in parallel when it is being re-factored.

Activity 3: Migrate the e-government services

Migration: Once the activities in this stage are completed the system migration and integration process begins. This is purely technical part which needs involvement cloud migration experts, and government IT staff to assess the migration process and performance of the migrated systems in the cloud platform. The migration process is defined based on the migration strategy. In most of the cases the large enterprise application, like e-government uses re-factoring approach, as the legacy system continuously work without interrupting business process.

4.3.4. Stage 4: Evaluate

Evaluation is the final stage of the sustainability-driven e-government model assimilation process. The stage involves evaluating the performance of the proposed model from organisational and technological perspectives. The evaluation process includes comparing the performance of the e-government services after implementing the sustainability-driven e-government model with the government goals and other technical performance indicators defined in the third stage. The organisational performance indicators are derived from the government vision and goals, i.e. streamlined e-government services, service delivery time, efficiency in the government process and cost saving. Similarly, the technological performance indicators are derived from the security requirements and e-government vision, i.e. secure, Scalability, availability, rapid deployment and reliability. Figure 4.9 shows the evaluation process.

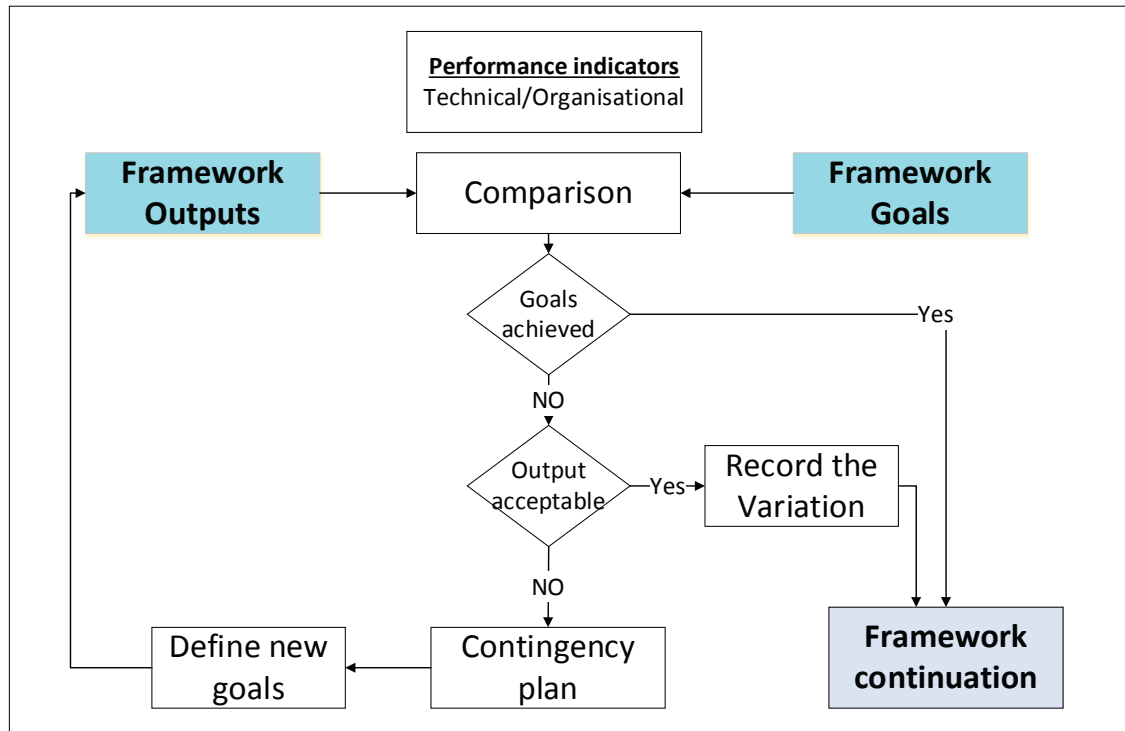


Figure4.9: Performance evaluation process

Activity 1: Organisational performance evaluation

The aim of the activity is to evaluate the performance of the e-government services in the context of the organisation performance indicators. To evaluate the different organisational performance indicator different techniques should be used.

- *Cost efficiency:* Cost benefit analysis could be used at this stage to evaluate the cost saving after the government adopt sustainability-driven e-government model.
- *Customer satisfaction:* Customer satisfaction could be analysed by employing survey method. Customer satisfaction should be measured from different perspectives, i.e. quality of service, access to the services, ease of use, and complexity.
- *Business process efficiency:* The overall efficiency should be measured by analysing service delivery time, collaboration among the government department, and elimination of information hierarchy. This could be done by observation and interview with the government employee

Activity 2: Technological performance evaluation

The technical performance evaluation takes MSA and SLA in consideration while evaluating the technical performance of the e-government system. Technological performance evaluation is done in the different dimension.

- *Integration: This dimension evaluates whether the different e-government services have smoothly integrated in the cloud platform for the streamlined services.*
- *Load handling: The e-government service is tested for its load handling capabilities. The one of the rational for adopting cloud computing platform is to support the inadequate on-premise infrastructure that poorly handles the load. Therefore, based on the parameters defined in the SLA the load handling test is done. The response time of the e-government service in the normal condition is peak condition is tested for its performance.*
- *Stress testing: This is particularly important as it test the strength of handling increased demand of the service at any time. E-government services should be agile that handles the demands in the peak hour and automatically scale-out when required. The stress test evaluates the capacity of the e-government service to handle maximum number of the user at a time without comprising the performance. The results of the stress testing are also compared with the parameters defined in the SLA.*

A check list (See appendix F) have been developed under each parameter based on the service level agreement.

4.4. Summary

This chapter provides a detailed discussion on the concepts used to deliver sustainable e-government service based on the maturity model proposed in the chapter three. The chapter focuses on the e-government implementation approach and technological used to achieve the approach for sustainability. The sustainability-driven e-government model assimilation process has been divided in four stages under which different activities are organised to attain sustainable e-government service. The first stage deals with the establishing vision and identification of the e-government goals. E-government requirement based on the goals and approach is also discussed in this stage. The second stage deals with the preliminary investigation for the cloud feasibility that ensures if the implementation approach could be achieved. The third stage discusses, the e-

government service migration process. The final stage provides a brief discussion on how the outcomes of the sustainability-driven e-government services will be evaluated.

The aim of this chapter is to present the research design and methodology used in this research. The chapter provides a brief introduction of the different research methodology and discussion on the rationales of selecting the methodology for this research.

The chapter starts with the introduction to the research methodology that is followed by research approach. The chapter presents the different types of research approach and context they can be used. Moreover, the research design and strategies used in this research along with the research process is also discussed in this chapter. The data collection methods, and analysis methods have been described in brief. The chapter further discusses the benefits and limitations of the adopted research methodology and the measures those have been taken to avoid any research bias. Finally, the chapter summarise the research methodology used in this research.

5.1.Research methodology overview

Research is a systematic process of exploring, investigating or experimenting the ideas or events to generate knowledge in a subject domain (Bryman, 2016), which requires different methodologies. Walliman (2017) describes research methodology as a process model which provides procedures of conducting the research. Taylor et al., (2015) defines, methodology is a way that a research adopts to address the research problem and seeks answers. There are number of factors, i.e. research questions, research aim and nature of research, that play crucial role in selection of appropriate research methodology. The selection of the methodology is greatly influenced by the characteristic and nature of the research. Generally, research in information system falls into the applied science domain where existing technology and knowledge is used to generate new ideas and knowledge in the subject domain (Vaishnavi & Kuechler, 2015). Urquhart & Fernandez (2016) say the researches in the information system domain are focused in the effective application of the technology, issues in the technology, and how these technologies could be better aligned to the necessities of the people and organisations. Therefore, the research in the information system covers technology, people and organisation (DeLone et al., (2016). E-government falls in the information system research domains which requires high attention in designing and executing the research as it covers wider subject domain, i.e. technology, business process, organisation structure and political science (Yusuf et al., 2016, Alenezi et al., 2015). Urquhart & Fernandez (2016) claims that there is no single universally accepted research method in the information system study, neither a single method is sufficient to study all the aspect of the information system, Therefore, the selection of the appropriate research method depends on the aim and objective of the research. Sometimes it is necessary to employ more than one research methodology to study an individual phenomenon, such research has been termed as epistemology (Yin 1984).

5.2.Research approach

Selection of an appropriate research approach is crucial for a research study. Research approach has been defined as a systematic action taken to collect research data and analyse the data to draw the findings (Stage & Manning 2015). Hammersley (2017) found that there is a lot of discussion among the researcher in relation to the superiority of one approach over other. There are different types of research, i.e. inductive, deductive, exploratory, experimental, and descriptive, those are broadly categorized as,

qualitative and quantitative and mixed method approach (Ormston et al., 2014). The selection of the research approach depends upon the research aim and objective and types of inquiry.

i. Qualitative approach

Qualitative research approach studies social phenomenon and allow researcher to interpret and develop deep understanding on the research findings (Lewis, 2015). Silverman (2016) says qualitative approach allows use of different technique, i.e. case study, observation, interview to investigate a subject and provide a descriptive analysis of the problem. Qualitative research approach is uses holistic approach to understand the research phenomenon and provide the reader a narrative discussion on the research outcomes. Smith (2015) says qualitative research approach collects data in the form of verbal and written report, i.e. interview, transcript or report, and the findings are presented in the textual form. There are five data analysis methods, namely case study, content analysis, phenomenological, ethnography and grounded theory as suggested by Leedy & Ormrod, (2001). Taylor et al., (2015) says qualitative research is used while the researcher aims to seek, reasoning, opinion and motivation of the participants. The qualitative approach of data analysis support researcher to develop ideas or form hypothesis for the quantitative research (Merriam & Tisdell 2015). O'reilly & Parker (2013) defines qualitative research as sociological research where researcher seek to understand human behaviour, particularly the researcher assesses, why the behaviours of the people is influenced by their thought in a particular subject. In information system research, the qualitative approach is adopted to understand why people use or adopt an information system, and what are factor those influence the user decision to adopt and use the system. Myers (1997) says researches in the information systems mainly use qualitative research approach, as it allows the researcher to relate the problems with the real-life situation. Moreover, it supports researcher to understand the how a new technology or information system assimilates in a society.

ii. Quantitative approach

Kaplan & Duchon (1988) says quantitative research approach is more systematic that tend to assess research phenomena in numerical values, i.e. “how much, How many or how often”. The findings from the quantitative research are more accurate could be easily generalized. The quantitative research approach is used when the research

phenomenon could be numerically measured. Creswell (1996) defines the main characteristics of the quantitative approach is, relating the problem with specific variable those can be numerically measured, defining hypothesis and testing the hypothesis and theories by using different methods, i.e. instrument or observation. Unlike the qualitative approach, quantitative approach does not seek to interpret user opinion, rather it investigates the factors those have influenced the user opinion (Lewis, 2015, Tylor, 2015 and Smith 2015). Burns & Bursn (2000). Says that the quantitative approach allows to analyse different variables, and their relationship in a given context. Quantitative research approach is equally used in the information system research when a researcher aims to assess user opinion and view on an information system product or service (Kaplan & Duchon 1998). In relation to the sustainability of the e-government services which relay on wider acceptance and adoption from the user, quantitative approach should be used to assess the factors those impact the e-government service adoption decision.

iii. Mixed method research approach

When researcher adopt one or other research approach, some research required adoption of the both approaches which is called mixed method approach (Brannen, 2017). Venkatesh et al., (2013) found that in recent year mixed method research approach has been a seen as a viable alternative to the quantitative and qualitative research. Jick (1979) says mixed method research is an approach of conducting research by adopting more than one research methods which includes data collection and analysis in a single research study. Johnson & Onwuegbuzie (2004) argued that the researcher findings are superior whose are obtained by employing mixed method approach in comparison to mono-method research approach. Mixed method approach which employs methodological pluralism or election is useful when the research requires numerical facts along with the interpretive and descriptive analysis of the findings (Dow, 1997). Denscombe (2008) defines the mixed method research approach as a “third paradigm” for conducting research which could produce more meaningful and distinctive research outcomes. Mixed method approach is particularly useful when a single method of data collection and analysis is not enough to address the research problem. Although the mixed method research approach allows the research to become flexible to use different methods of data collection and analysis, drawing a conclusion and relating the findings

achieved from the different data collection method needs serious skill (Tashakkori & Creswell 2007).

Qualitative	Quantitative	Mixed method
<ul style="list-style-type: none"> • Relatively less time consuming, and can be implemented quickly • Findings are rich in understanding • Used to understand human behaviour and opinion • Could be misleading and biased findings if not used appropriately • Lack of accuracy as it lacks statistical data • Require precise interpretation of the research findings • Low level of generalizability of the research findings 	<ul style="list-style-type: none"> • Findings are statistically accurate • Findings allow to generalize research outcomes • Takes more time and resources • Requires high level of statistical knowledge • Structured approach and standard procedure of data collection and analysis • Defines problems as variable and provide relationship among the variables as research findings 	<ul style="list-style-type: none"> • useful when a research subject requires both qualitative and quantitative data and information • more balanced research findings and provide rich understanding • takes more time than the other two to conduct • requires high level of skill to relate qualitative and quantitative findings • use statistical and descriptive approach to deliver and to generalize the findings

Table 5.1: Characteristics of the different research approach

All the research approaches described above have their benefit and limitation while used in a research study. The discretion should be applied by the researcher while selecting types of research method. However, the selection of the approach should be justifiable and appropriate rationales should be provided (Jackson, 2015). Smith (2015) says inappropriate research approach would produce unreliable research outcome and validity of such research findings are questionable.

5.3. Research method used in this study

As discussed in the previous section, a particular research method is not sufficient while a research comprises of a multi-disciplinary field. Therefore, the selection of the research methods has been carried out by carefully considering the research questions and the research aim and objectives as recommended by Yin (1984). Since the research involves development and implementation of a sustainability-driven e-government maturity model (SDEGM) and the evaluation of the model from e-government sustainability perspectives, both qualitative and quantitative approach has been adopted. Action research method has been employed by using case-studies and survey to evaluate analyse the usability of the proposed model. Cases studies evaluate the technical aspects of the model while the relevance and usability of the model will be evaluated based on the survey results. The researcher has adopted descriptive and interpretative approach of data presentation as it aims to provide an understanding on how the

determinants of the proposed model have impacted on the sustainability of the e-government services.

5.4. Research design

Research design provides an outline of the research that provides logical sequence of the task or activities those are being implemented to complete the research. Creswell (1996) and Bordens, & Abbott (2002) defined research design as a structured set of guidelines for generating valid and reliable research findings, and for making sure that the findings have been obtained by employing reliable and valid research methods in line with the research problems. Maxwell (2012) defines research design as step-by-step plan that guides researcher to carry out the research activity in systematic approach to achieve research aim.

Figure 5.1 shows the research design followed in this research. The research design used in this research has four steps, and different activities under those steps those have been followed to achieve research aim. The first step is to review and analyse the literature in the problem domain to precisely identify the gap in the knowledge. It involves setting up the research aim and objectives, developing research questions and proving research rationales. In the second stage, a model has been developed to address the problem identified from the literature review. The models adopt holistic approach of problem solving by considering different determinants. Research methods for evaluation and validation of the proposed model are developed in the third step. The methodology has been adopted based on the nature of research aim and research questions. Both quantitative and qualitative unit of measure are used to evaluate the proposed model and synthesise the findings. Finally, data analysis and conclusion has been provided at the fourth step.

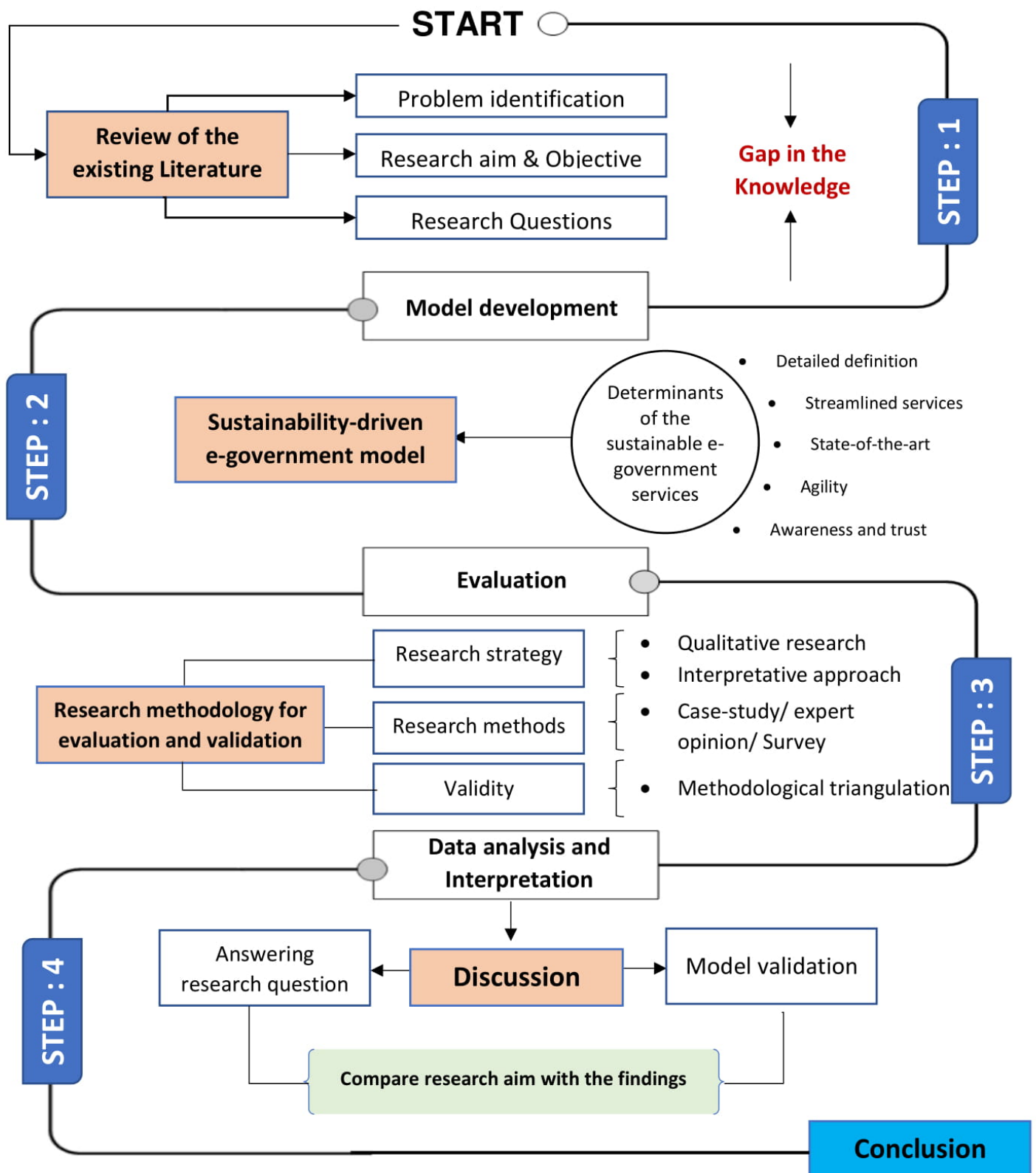


Figure 5.1: The research design

5.5. Research strategy

Coffey & Atkinson (1996) says research strategy provides guidelines for identifying appropriate research methods to assess, evaluate and validate the research phenomenon. It defines why particular research method would best fit in the research context and how the selected method would address the research questions (Lewis, 2015). Research strategy comprise with different components, i.e. research methodology, research, design, data collection methods, data analysis and validation. Creswell (1996) said research strategy is subjective, that the selection of the strategy depends upon the nature of research problem. Different author has presented number of research strategies based on different research context. Orlikowski & Baroudi (1991) said there are six types of research strategies; survey; case study; laboratory experiment; field experiment; action research and others. Similarly, Noor (2008) argued that there are only five types of research strategies; case studies, experiment, surveys, histories and analysis of archival information in the social research. Denscombe (2003) emphasise that there are only four types of research strategies exist that could be adopted in practice; case study; historical research; survey research and experimental study.

Research strategy	Research questions	Method
Case-study	What, why, and how	Researcher Investigate a phenomenon in a given research context.
Survey	Who, why, where, what, how many	Researcher generalize opinion or thoughts of a portion of population from a sample size
experimental	How and what	Researcher experiment a phenomenon practically to draw findings
Laboratory experiment	How and what	Researcher experiment a phenomenon practically to draw findings
Field experiment	How and what	Researcher experiment a phenomenon practically to draw findings
Action research	What, why, and how	Researcher closely participate in the investigation process to feel and observe how the research unfolds
Histories/archival analysis	Who, why, where, what, how many, when	Research analyse and investigate the historical data and information

Table 5.2: Types of the questions under different research strategies

Kothari (2004) argues that considering the different number of the research strategies suggested by the different researcher in the different types, one could note that the research strategy is subjective and should be adopted using best fit approach. The types

of the research question this research bares, the researcher has decided to adopt action research using case study and survey research strategy in this research.

5.6.Methodological triangulation

The researcher has used Methodological triangulation identified by Denzin (1978) that involves using more than one methodology to analyse and validate qualitative research. Patton (1987) defines the methodological triangulation as use of different research methods to study a single research problem. Altrichter et al., (2005) emphasised on using triangulation method to validate qualitative data and said, “triangulation gives a more detailed and balanced picture of the situation.” Kaulio & Karlsson (1998) said triangulation provides greater accuracy with more confident interpretation of the researched phenomenon as it utilizes different data sources. Therefore, the researcher has used different technique, participatory action research, expert opinion using Delphi method and survey to evaluate the usefulness and the adoptability of the proposed model in relation to the developing countries. Data has been collected using different technique in the different stage. In the first part of the study the data has been collected through the observation made during the model implementation process, and semi-structured interview and electronic questioner have been used in the second part of the study. Figure 5.2 shows the methodological triangulation.

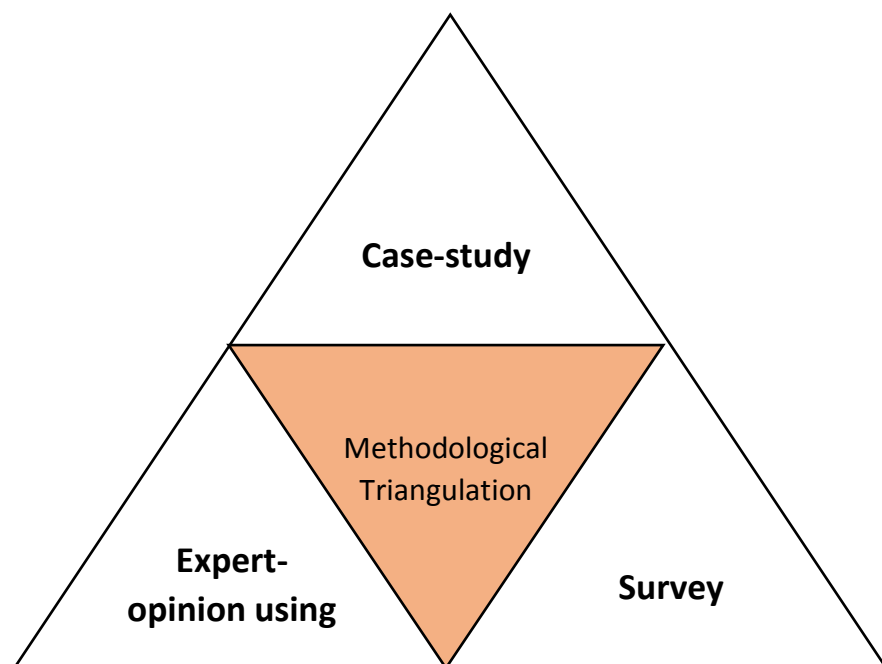


Figure 5.2: Methodological triangulation for evaluation

5.7.Action research

Brydon-Miller, et al., (2003) says primarily action research is meant to be applied in real situation to solve real-life problem rather than the experimental studies. It adopts holistic approach of problem solving which incorporates different methods and tools of data collections and analysis (Baskerville & Wood-Harper, 1996). One of the key difference between of the action research and other research method is the active participation from the research him/herself in the research that contradict with the objectivist science which argues that the research should be impartial spectator (Kemmis et al., 2013).

We have adopted participatory action research (PAR) approach to implement and evaluate the proposed framework as shown in figure 5.3. One of the rationales for adopting the participatory action research is the nature of this research that requires the interpretation of the findings in qualitative approach with reasoning rather than merely presenting quantitative data (Costa et al., 1991). Moreover, the action research provides high level of practical relevance to the subject being studied. Action research allows to gather data by employing various methods i.e. observation, experiment, interview and written cases. We have utilized interview, observation and case study method to collect the data.

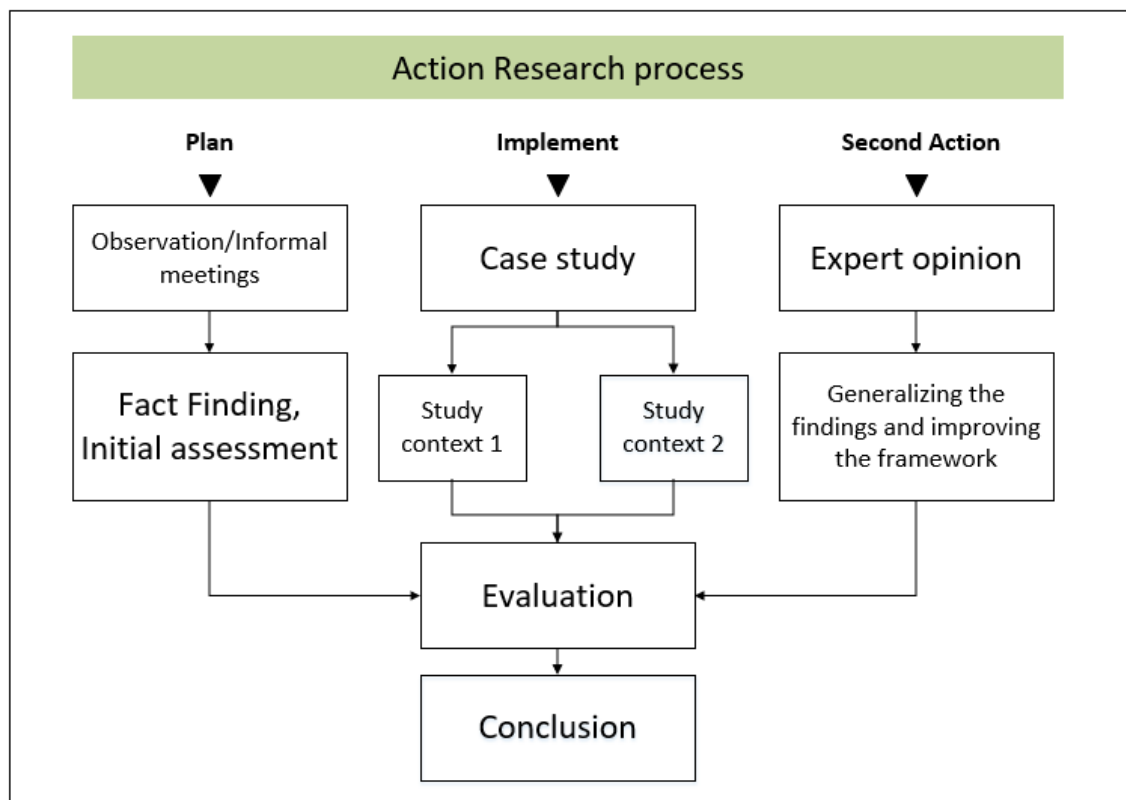


Figure 5.3: Evaluation approach for proposed model from implementation perspectives

The initial data has been collected through informal and less structured interview and observation to understand the existing e-government system in the study context, and to better plan the model implementation process. The interview instruments are open ended those were designed to get in-depth understanding of the current state of the e-government development and the issues faced. We have employed case study method to implement the model in the real e-government projects in two different department of the Nepal government. The data has been collected by observing, recording the outcome as the model being implemented. The findings have been generalized by taking a second action that employed expert opinion in relation to the usability of the model in the context of the developing countries.

5.8.Case-study

Walsham (1995) says the case-study method has been extensively applied in the information system research, as it provides tools to study complex research phenomenon in a given context. The case study methods allow researcher to investigate the research context in detail and support and to develop theories from the findings (Baxter & Jack, 2008).

The researcher has conducted two different case studies in the two-different e-government projects context. The rationales for selecting two different e-government projects is to confirm that the model could be applied in the different context. The researcher has used various data collection technique during the case study. Initial data collection has been done from the secondary sources, i.e. previous research, government reports, reports from the different organisation in relation to the e-government initiative in Nepal. Once the case-study has been commenced to implement the proposed model, more structured way of gathering data, i.e. informal and formal interview, observation of the outcomes as the model being implemented and technical performance evaluation by using different tools. The table 5.3 shows the different data sources along with their use and outcomes.

Data source	When	Outcome
Government report	- initial phase of the model implementation	- Government reports have been used to assess the current state of the e-government development to make understanding on what has already been done, what is lacking and how the issues could be addressed.
Informal meetings	- Initial phase of the model implementation - During the model	- Informal meetings have been conducted to get insight of the government efforts made to improve the e-government services. Also, the informal meetings with

	implementation	the government employee paved the way to get agreement of the department to implement the model.
Interview	- During the model implementation	- Structured interview using subjective and objective question have been conducted with the government official to evaluate how the process and activities defined by the model are being implemented. What difference it made in comparison to the traditional e-government project implementation.
Observation	- During the model implementation	- Observation has been done throughout the implementation process of the model. Made a note of how sustainability-driven e-government maturity model (SDEGM) is performing. Technical performance has been observed along with the organisational performance.

Table 5.3: Data sources used in the research*Case-study context*

The study context is Nepal as a developing country. Nepal is a landlocked country with vast geographical diversity and is characterized by a highly centralized government. Local administration is performed through numbers of administration districts. At present, it has 5 development regions, 14 zones and 75 districts, however it is going through a serious reform following constitutional assembly election in 2008 and 2013. E-government initiative in Nepal started in 2006, with funding from the Korea IT Industry Promotion Agency (KIPA). The government had announced the project called the electronic government master plan of Nepal, which has proposed 21 various electronic government projects with the estimated budget of 65 million US dollar. Later only 8 projects were selected for execution because of the insufficient fund. The Asian development bank granted support of 25 million US dollars and the Nepal government contributed only 6 million US dollars (Rupakhetee & Heshmati, 2013). Studies on the effectiveness of these e-government projects in Nepal have found that the master plan has failed to achieve its objective (Rupakhetee & Heshmati, 2013, Shakya & Kharel 2013), as such the researcher has selected the e-government project of Nepal for evaluation of the proposed model.

Area of focus

Among the various government departments those are offering e-government services the case-study will focus in two different department of Nepal government.

The first case study was conducted in the citizenship verification service. The citizenship cards are issued by the District Administration Office and the Area Administration Office upon recommendation by local bodies, pursuant to the Citizenship Act, 2063 Bikram sambat (B.S.). The details of citizenship are held in their respective districts and must be manually fetched. Alternatively, users must verify their citizenship cards from the districts they have been issued each time they require certain services (e.g., to get Nepali passport). This has become a critical issue for citizens residing far from home. These citizens must travel to their respective districts just to get verification, which is then brought to the ministry of foreign affairs prior to getting a passport. This process takes considerable time and cost making government services less user centred and inefficient.

The second case study was conducted in the licencing unit of department of transport management that has its own online portal that at present allows residents of the Bagmati Zone (one of Nepal's 14 zones) to apply for a driving license. However, the services of the online portal are only available during the office hours and only limited to the Bagmati zone. Although the driving licensing department in the different zones uses their own legacy system, lack of integration and consolidated data across the departments in the different zones restrict the efficiency of the government services.

In both cases the e-government services are inefficient, incomplete, and less user centred making them less sustainable for the future. Therefore, the researcher has selected these two department to implement sustainability-driven e-government maturity model (SDEGM) to achieve sustainable e-government services.

5.9.Expert opinion

We have adopted expert opinion using two round iteration Delphi. Skulmoski et al., (2007) says the Delphi method is useful for masters or PhD student to gain judgement of the expert in the subject domain by using iterative process. Expert opinion is one of the widely used research method for evaluating a product and services in the information system research. The approach is less structured and less formal, which can be used for the different purposes, i.e. problem identification, evaluation of a product, evaluation of the services and to clarify issues in the subject domain (Dalkey & Helmer, 1963). Hasson et al., (2000) says expert opinion is generally used to identify potential strength and weakness of a product before it can be made available for the customers.

Clayton (1997) says that expert opinion could be used at any stage of the product development to enhance the product quality and to address any issues in the product. Expert opinion involves number of domain experts make their opinion in relation to the provided research phenomenon. This could be done individually, or in a group by using different techniques, i.e. questionnaire and face-to-face interview. Although the expert opinion method is less structured and requires less effort to achieve, the researcher must consider different factors while selecting the experts (Landeta 2006). Especially, to avoid the biased opinion, the experts should not have any prior involvement in the product and service design and development.

In this research the expert opinion has been used to generalize the findings of the case study and gaining opinion in relation to the usability of the proposed model in the different country context. The researcher has made a list of potential experts in the domain. Since the research different subject area, i.e. technological, organisational, and user perspectives, experts have been selected from all these subject areas. While selecting the expert the researcher has considered, length of time the expert is working in the domain, contribution in the knowledge, their role in the subject, educational qualification or any achievement in the subject domain and their area of interest. The research has used two round iteration Delphi for expert opinion. The case study results have been presented in the introduction season. The features of the model, its usability, and activities have been briefly explained to the participants.

5.10. Survey

Survey is an important tool to generalize ideas or findings from a portion of a population (Fowler, 2013). At large it has been considered sociological investigation tool that seeks the opinion of the people or any behavioural changes in the research context (Rossi et al., 2013). Gable (1994) found survey researches handy and could be rapidly applied when required, while the findings could be relied upon to introduce product or services provided that the random errors are within the limits. In information system (IS) research, survey is used to assess the user satisfaction or their opinion about the products or services. Newsted (1998) said survey research makes use of questionnaire to analyse and assess the research subject. This research has adopted the survey method to evaluate the usefulness and adoptability of the e-government services after the implementation of the sustainability-driven e-government maturity model.

Survey context

The context of the survey is an e-government service that has been implemented by using sustainability-driven e-government maturity model (SDEGM) in one of the government department in Nepal. The survey was conducted on 200 university students and 200 residents of a city, both of whom were relatively familiar with technology. Participants were at least 18 years old, had basic IT skills, and had completed secondary education. The researcher has considered participants who has recently used e-government services for passport application or license application and had used the online service offered by the government.

5.11. Data analysis

The collected data is analysed using both qualitative and quantitative methods. The researcher has applied various data analyses techniques, i.e., regression analysis for quantitative data, and an inductive approach for qualitative data. For the quantitative data analysis, the researcher has used GNU PSPP 1.0 software that allows to document, categorize the responses and provides statistical data analysis. A multiple regression analysis has been used to examine the impact of independent variables (agile accessibility and trust/awareness) on the dependent variable (users' decision of adopting e-government services).

5.12. Validity of the study results

Validity is a most important aspect of the research that needs to be discussed and established precisely. Especially when employing interpretivist research, i.e. action research that lacks the guidelines and universal framework, the researcher needs to be more cautious while collecting and analysing the data (Altheide & Johnson (1994). As such we have followed the four criteria set by Lincoln & Guba(1985) those are well regarded for rigour in qualitative and interpretivist research.

Credibility: research credibility should be established to validate the study results. Credibility in the qualitative research is gained by precisely defining the research parameters, i.e. theoretical model, research method for data collection, rationales, justification, and participant selection criteria. In qualitative research credibility is parallel to the internal validity where research setting, instrument design, and validation is done. In this research the credibility has been established by defining appropriate

research methods and their rationales at beginning. Different research methods have been discussed and justification of the selection method for model implementation has been provided. For the credibility of the survey method, we have precisely defined the participants, selection criteria, instrument design and test and finally a software has been used to manage and organise the data.

Transferability: Transferability in the qualitative research can be defined as a generalizability of the research findings. In the qualitative research, i.e. case-study and action research the findings might be hard to generalize as contrast to the survey method. Therefore, the outcomes should be appropriately interpreted while presenting the findings. The researcher has used methodological triangulation to generalize the findings of the case study. We used two sets of cases where the same model has been implemented with the expert opinion. The findings have been then compared for generalization purpose.

Dependability: Research dependability is like the reliability in the qualitative research. Lack of solid numerical facts and, guidelines used while retrieving information makes qualitative research findings less reliable. Therefore, extra caution needs to be applied while interpreting the data. Researcher should not distort information by misinterpreting the findings. Reliability in the qualitative research depends on the transparent process, traceable evidences of the data sources, and keeping track record of the process as it happened. In this research reliability of the case study has been established by presenting the observation of the case-study and the opinion of the participants as it is. The expert opinion findings have been presented by quoting their own words. Meanwhile face validity method has been applied to test and customize survey instrument.

Conformability: conformability is avoiding any bias in the qualitative research. It requires that interpretation or the judgement of the research findings are logical. Conformability could be achieved by involving expert of the subject to confirm the findings are logical. The researcher has employed expert opinion method to further generalize the interpretation of the findings retrieved from the case studies.

Although the researcher has carefully considered the design and execution of the research methodology, there is always a risk of expectancy bias in survey and case-study results. The researcher has tried to reduce it by taking different measures. As

such, university students have been trained and used them to conduct the survey, as they were not directly related with the research. For any empirical investigation, it is necessary to ensure the availabilities of resources and participants, and the researcher confirmed these before initiating the investigation. Participants were selected based on specific criteria so that they could understand the questions. This reduced the threat of asking the wrong questions, validating the constructs. The researcher has used multiple data sources for both the survey and the case study in an effort to reduce the effects of interpretation of a single data source.

5.13. Chapter Summary

The chapter has provided a brief discussion on the research methodology, the approach of the research from the different perspectives. Mainly the chapter focus on the methodology and research design used in this research. It discusses the rationales for selecting the methodology, and how the research has been unfolded in the different stages. Overall this chapter provides a skeleton of the research from start to end. The chapter discusses action research and survey method in detail. The design, construct and validation techniques for the used method has also been discussed in the chapter. Finally, the chapter discusses how research reliability and validity has been ensured to avoid research biases.

This chapter provides an evaluation of the sustainability-driven e-government model. We have employed action research method including case-study and survey for the purpose of evaluation. The data has been analysed by using descriptive and interpretive approach. Furthermore, expert opinion has been used to generalize the findings and customize the model as deemed appropriate.

The focus of the chapter remains on the evaluation of the model for its contribution in designing and implementing sustainable e-government services in the developing countries. The evaluation chapter seeks to justify whether the aim and objectives of the research has been fulfilled or not, while answering the research question.

6.1.Introduction

Evaluation of the proposed model has been done in three stages as shown in Figure 6.1. The first stage presents the implementation of the proposed model by employing case study method in two different departments of the Nepal government. The purpose of the first case study is to evaluate and to justify, how bringing integration stage before transaction stage support the government to deliver complete and streamlined e-government services to the users in the developing countries. While doing so we evaluate the implementation determinants of the sustainability-driven e-government maturity model. The case study focuses on how integrating the proposed determinants in the maturity model would contribute in designing sustainable e-government services. The second case study evaluates the usability and applicability of the e-government approach defined by the proposed model for delivering sustainable e-government services from implementation perspectives. The case study also evaluates the adoption of cloud computing for integrating and implementing e-government services in the developing countries from sustainability perspectives. The second stage presents the findings from the survey conducted in two different groups of e-government users to evaluate the sustainability of the proposed model from the adoption perspectives. The final stage presents the findings of the expert opinion. The expert opinion method evaluates the sustainability from overall perspectives and the findings are used to generalize the outcomes.

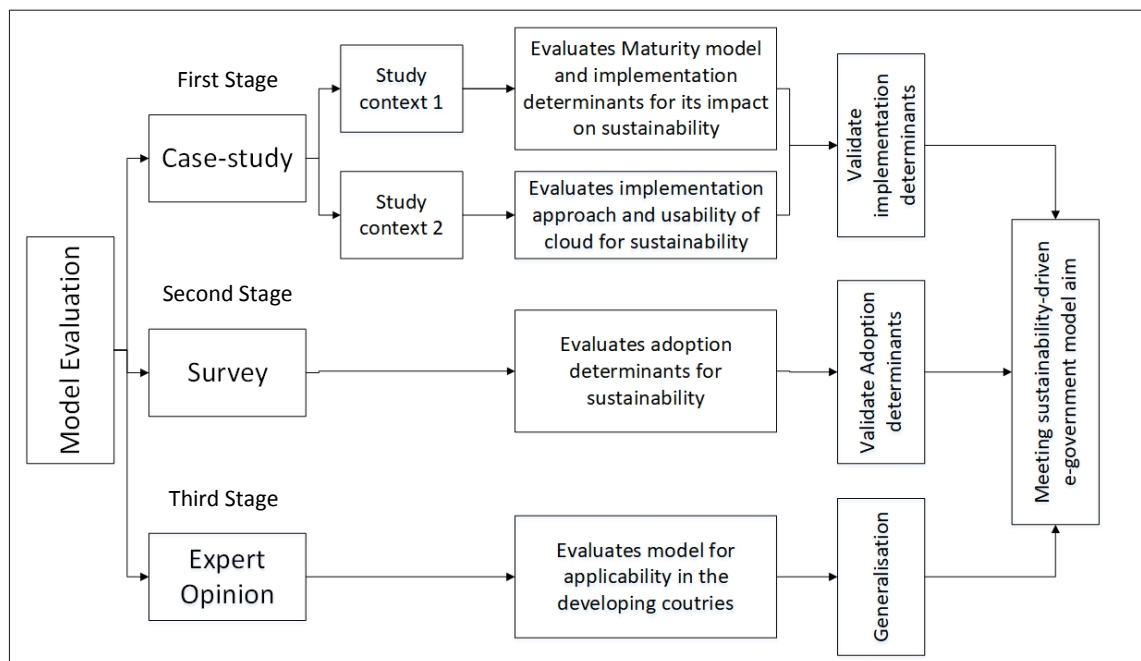


Figure 6.1: Evaluation process

6.2.First Stage: Case study

Case Study context

The context of the case study context is Nepal, which is located between India and China. Following the recent constitutional assembly election, the government has adopted federal structure for governance and divided the country in seven states. Since the governance structure has been going through huge reform, the government is under process of making new policies, legislation, and reform the government process to accommodate the changes. Along with the other changes the government requires changes in e-government initiative. Different states are in process of designing their own e-government services based on their requirements. Therefore, it is practically easy for us to implement our model as a pilot project.

The e-government initiative in Nepal has been started in 2006, government with support from the Korea IT Industry Promotion Agency (KIPA) which is known as e-government master plan of Nepal. The government aim to provide better governance and make the government services available online for the citizen to minimize the bureaucratic interference in the service delivery. The master plan has aim to interconnect the government departments in 5-year time that is by the end of 2011 and would be able to provide citizen centric and transparent services to the stakeholders (Kharel et al., 2013). Before that in 2000 government announced its IT policy, in 2002 established National technology Centre (NITC) and in 2004 the government has announced the telecommunication act. The NITC was established to support government of Nepal to conduct various activities to foster the e-government projects. At present the NITC act as an e-government implementation hub. Furthermore, it provided common facility to the government agencies to host their servers. NITC also provides internet access through optical fibre to the government ministries and departments located inside the Singghdurbar (central administrative premise) compound. Domain registration of the different government departments and the web hosting service for the government departments is also provided by the NITC. In 2009 Nepal government has received grant from Korean government to establish a Government Integrated Data Centre (GIDC). The GIDC is responsible for housing the servers of the Nepal government department and agencies. A replica is being built in the different part of the country (Hetauda) as a backup for the disaster recovery. Nepal government has also been working to improve the internet connectivity of the country.

Recently Nepal is connected to the china by optical fibre network through the Geelong Keyrong-Rasuwgadhi border point (Business Standard, 11 June 2016).

E-government service assessment

Although the maturity level of the electronic government project is considered in its first stage Nepal government is offering some G2B and G2C services through the web portals. There is no such study is available that assess the efficiency and effectiveness of the offered services. Also, there is no such data available that shows the number of transection that the government has provided through online services. However, some of the services are gaining popularity. One of the system that is gaining popularity is Foreign Employment Information Management System that allows the workers going abroad for employment to check their visa and employment status

Service title	Service description	Government Department	Service type
PSC e-Service	Public Service Recruitment Management System (PSRMS)	Public Service commission	G2C
Validate VAT/PAN	Validate VAT or PAN Number	Inland revenue department	G2C/G2B
OCR e-Services	e-Services from Office of company register	Office of company registrar	G2B
Business Licenses Portal	Business Licenses Portal	Office of the Prime Minister and Council of Ministers	G2B
Issue of PAN to a person	PAN Registration of Individual Taxpayers for TDS Collection Purpose only	Inland revenue department	G2C
Issue of PAN to an entity	PAN Registration of Limited Companies, Public Limited, Private Limited, Hospitals, Schools, INGOs, Joint Ventures and Proprietary Businesses	Inland revenue department	G2B
Registration in VAT	Registration of entity having Business PAN in VAT	Inland revenue department	G2B
Filling of TDS Return	TDS Return filing and Verification	Inland revenue department	G2B
Filling of Income Tax Return	Income Tax Return filing and Verification	Inland revenue department	G2C
Filling of VAT Return	VAT Return filing and Verification	Inland revenue department	G2B
Get PAN Detail	Searching PAN Registration Detail	Inland revenue department	G2C/G2B
e-BPS Lalitpur Sub-Metropolitan City	Electronic Building Permit System, Form download, Application tracking, land unit conversion	Lalitpur Metropolitan City	G2C
e-BPS Kathmandu Metropolitan City	Electronic Building Permit System, Form download, Application tracking, land unit conversion	Kathmandu Metropolitan City	G2C
Foreign Employment Information Management System	Search facilities of the personal foreign employment permission detail	Ministry of Labour and Employment Department of Foreign Employment	G2C

Personal Information System (MOGA)	Government employee database, detail change, discloser service	Department of Civil Personnel Records	G2E
Driving licence	Download form, see licence detail (service available for citizen of Bagmati zone)	Department of transport management	G2C

Table 6.1: E-government services offered by Nepal government (NITC, 2017)

The table 6.1 shows the number of government services available online. Among them government has given priority in the government to business (G2B) and government to citizen (G2C) domain. From the above table we can see there is no effort has been made to initiate to integrate the government services within government to government (G2G) dimension. There is only one e-government service is offered in government to employee (G2E) dimension. While the numbers of the electronic government services are increasing, the usability of these services remains questionable, as no such data is available whether the services are adopted by the users. Joshi et al., (2017) has studied the e-government master plan Nepal and found several issues in the offered e-government services, such as lack of accessibility, language problem, and poor quality of information, lack of help and support, lack of integration of the government departments, lack of scalability and lack of availability of the services. The recent example of service outage because of the lack of scalability is; the server under public service commission has been crashed as it failed to handle the excessive number of request from the user (Ekantipur, 16 Feb 2016, p8). Furthermore, the online services do not contain complete information i.e. there are only a portion of the business detail available in the business portal, the service required secondary verification, and lack of payment gateway makes the services incomplete as the user has to visit government office or bank to complete the transaction.

Existing e-government maturity model

Government of Nepal has followed four stages e-government maturity model that is influenced from the model developed by United Nation (2004) and Layne & Lee (2001). However, the stages have been customized to fit in the country's context. The government of Nepal has aimed to develop the e-government in the following stage.

- **First stage:** Computerization of internal process of the government.
- **Second Stage:** More comprehensive and citizen-centric services through Business Process Reengineering and connection of government agencies.

- **Third Stage:** Availability of integrated on-line services through connection of government agencies and to handle the citizen's requests online through web. This stage ensures citizen-centric, customized services.
- **Fourth Stage:** The processes are integrated within a ubiquitous environment where citizens and businesses can use any necessary service.

The electronic government project of Nepal is still in its early stage. Although the government has aimed to provide the citizen centric e-government services by the end of the year 2011, government couldn't achieve significant success in e-government by the end of the year 2017. Therefore, the e-government project is running well behind the schedule. Beside this, the initiation that had been taken in 2006 seems failing to align with the current need of the government and citizen. The project was design considering the technology available at that time, however the scenario has been changed dramatically since then. The table 6.2 present the proposed Nepal e-government maturity model and the achievement it has made.

Layne & Lee (2001)	Process	Nepal e-government maturity model	Maturity level of Nepal e-government
Catalogue	Establish website to make online government presence.	computerize	Websites, government portal, some department have social media pages, some websites offer downloading of forms, some department's web pages are up to date.
Transection	Two-way communication, government offer financial transection online	citizen-centric services through innovation in administrative process via BPR	Very limited two-way communication, no financial transaction could be completed online.
Vertical integration	Government departments are interconnected at different level (local government department connects with central department	Integrated services through connection of government agencies/ Online service	No connection among the government department at different level
Horizontal integration	All department connect with each other forming a web that allows government to provide complete automated service.	knowledge-based government is established	No connection among the government departments.

Table 6.2: Comparison of Nepal e-government with Layne & Lee's maturity model

Nepal government has established a national e-government portal and some of its ministries, and government departments have established their websites. The websites offer very basic services, i.e. government notices, information about the government departments and various application form downloading facility. The

government hasn't yet achieved the connectivity among the government departments and the ministries. However, it has established a data centre where the different ministries and government department co-locate their servers. The data centre is run, maintained and managed by the National Information Technology Centre(NITC). This department is responsible for making the government strategy and plan for the electronic government. The government is also in process of establishing another data centre in Hetauda for disaster management. Although the government is committed to implement the electronic government the efforts made by the government are very limited. Therefore, the government needs to adopt an effective and alternative approach of e-government implementation that maintains sustainability of the e-government services.

6.2.1. Case study 1: Evaluation of the maturity model stages

The first case study is conducted on the citizenship verification service in the government department that regulates passports in Nepal. While making an application for a passport, the applicants required to submit a verified copy of the citizenship card along with a recommendation letter signed by the government officer from their district of residence. In the absence of consolidate citizen data, the information required to process an application is manually fetched. This has become a critical issue for citizens residing away from homes. The citizens must travel to their districts, from where the citizenship card was issued, just to get verification, which is then brought to the ministry of foreign affairs to get the passport. This process takes considerable time and cost, as transportation in various areas in Nepal is still a big issue. While government has tried to address this problem by establishing an online portal and accepting online application for passports, the manual verification of the documents makes the online services less effective and usability of the service becomes poor. Therefore, the case-study is conducted in this department to evaluate how sustainability-driven e-government model will support the government for designing more usable e-government services. Meanwhile the case study also seeks to justify why integration stage should be completed before to pursue transaction stage for sustainable e-government services.

6.2.2. Study objectives

We have identified two objectives for the study

- *Objective 1: To justify the rationales for bringing integration stage (streamlined service) before the transaction stage*
- *Objective 2: To validate the rationales for including the implementation and adoption stages in the maturity model for sustainability.*

6.2.3. Study plan and team

From the initial investigation we found that the Nepal government had adopted a four-stage model, like Layne & Lee model, for the assimilation of their e-government project and achieved the first stage of the maturity. Once we decided the maturity level of the e-government and made our initial investigation on how passport department works to deliver services, we assembled a team to conduct the case study. Firstly, the researcher has approached government officials in the department for their participation in the case study. After a few attempts, the officials were convinced to pilot the proposed model. However, they did not agree to test the model with their live system. We all agreed to replicate the e-government services and reformed them as described by the proposed maturity model.

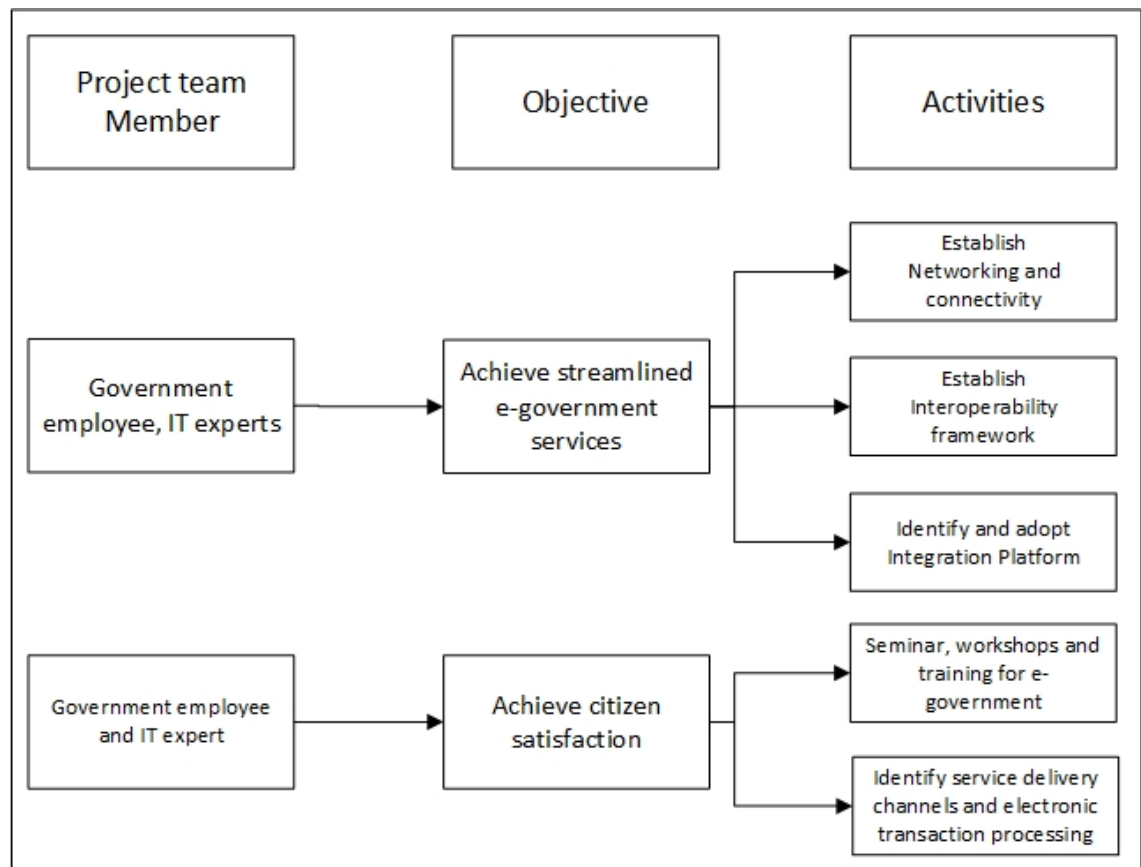


Figure 6.2: Case study Plan

We formed a team of government officials, e-government Information technology (IT) staff, and a local entrepreneur who provided us with technological support. The team members worked together to implement the maturity model and observed the outcomes as the activities took place. The team members were allocated their roles in the case study which are given below:

- **Facilitator:** The main researcher facilitates the whole works and link with the proposed approach
- **Coordinator:** Senior government official has assigned the role of coordinator, who will help and support the team member from different domain.
- **Integration expert:** IT experts are assigned the role of delivering technological support required to implement the model
- **Quality controller:** Government employee are assigned the role of quality control to analyses whether the outcomes of the case study met the objective.

6.2.4. Implementation process

At this stage we need to implement the proposed model for the study context. However, as the study context already implement e-government service we started from implementation stage two of the model. We have analyzed the e-government services offered by the department and made several observations that has contributed in setting the implementation stage. The following e-government activities within the department have been noted.

- The department has an online portal
- The portal allows to download online application and submitted application
- The user data is held in different database in district offices
- The department also have Facebook and twitter page
- The department uses manual process (fax, or in-person) for user application verification

We mapped the above e-government service with the sustainability-driven e-government maturity model (SDEGM) stages that shows, the passport department has achieved first stage of the maturity. Therefore, the second stage (Streamlined services) needs to be initiated using this case study. Since we want to evaluate the role of

integrated e-government systems for sustainability in the context of the developing countries we will only follow the implementation stage two in this case study.

Implementation Stage 2: Streamlined Services

As decided by the participants, we started with the second stage of the maturity model. Unlike other maturity models (transaction in the second stage), the second stage of the proposed model is streamlined services, which can be achieved through the integration of government departments. The integration of government systems in various government departments is a complex task. In relation to the Nepali government, the servers of various government ministries are co-located. However, the e-government applications and systems used by the government department in the various districts are held within those districts and need to be integrated. The non-integration of those application and database has created data silos, and isolated e-government system. The data was individually held in various offices and required manual communication to share and transfer the data from one department to another or within the department at different level. The following activities are performed to achieve the streamlined services.

Activity 1: Enhance networking and connectivity

The first activity towards achieving streamlined services is to enhance networking and connectivity between government departments and offices located in various geographical locations. The government departments had already recognized the need for better internet connectivity and networking among them for seamless communication. As an effort to enhance internet connectivity, Nepal successfully built a fiber-optic network with China in 2018 to fulfill the increased internet bandwidth demand for e-government initiative. The government believed that the fiber-optic connection between Nepal and China would increase the reliability and speed of the internet connection and minimize the dependency on internet networks connected solely via India. In relation to internet access between government offices located in various districts, Nepal had successfully connected 55 of the 75 districts with the optical fiber network in 2017. Similarly, remote government offices had been connected to the central office through Code Division Multiple Access (CDMA) and third generation (3G) networks. However, these efforts are not enough to achieve sustainable e-government services. As this issue needs to be addressed by the government in policy

level we made our recommendation to speed up the process, and prioritize the task of networking and connectivity

Activity 2: Establish an interoperability framework

Interoperability is the one of the issues faced by developing countries. As various government departments develop their own system to digitalize their work, the integration of these systems becomes challenging. We investigated the e-government initiative of Nepal to assess the effort of the government to establish an interoperability framework for bringing uniformity among government systems. We found that the government of Nepal had recognized its importance and had established an interoperability framework. The final draft of the e-government interoperability framework, known as the Nepal E-Government Interoperability Framework (NeGIF), was introduced in 2010. The government defined interoperability in three dimensions: business processes and organizational interoperability, information or semantic interoperability, and technical interoperability. The government introduced various standards and guidelines for applications, databases, networks, security and firewalls, document types, and all other technological aspects for all government departments and agencies. All government agencies and departments must follow these standards and guidelines while developing an e-government service. In addition, Nepal government had developed enterprise architecture (EA) framework which defined different components of the e-government, and how sub-architectures and government systems should be designed to achieve interoperability.

Activity 3: Identify integration platform

Some of the critical factors in achieving the integration stage of streamlined e-government services are cost and technology. Physical integration of e-government systems is becoming complex as many government offices in rural areas did not have access to reliable internet connectivity. Therefore, as defined by the maturity model and lessons learned from the previous case, we put forward a cloud-based solution for the e-government system integration and implementation of new applications. While doing so we have assessed how, adoption of cloud computing platform for integration of the services could bring cost and time efficiency. Firstly, we compared the existing cost of the e-government service implementation and management with the tentative cost that the government will incur to adopt cloud platform. The total cost of the last physical

year for managing and operating the e-government system that includes, procurement of software and hardware, staff salaries, training, maintaining and running cost, is Rs 30,00000 (Approx. \$ 25856). This is significantly low in comparison to the other government department as the department co-locate its servers in the shared premise. The estimated quote received from the local entrepreneur to run the same e-government service in the cloud platform will be Rs 1700000 (Approx. \$ 14500). It shows that the department could save almost half of the cost by adopting the cloud platform.

Secondly, we compared the time and human resources the department would require integrating various data sources using traditional integration technology with cloud-based integration. We found that many of the government offices and departments in rural areas were still facing connectivity problems, with physical networking among the databases getting increasingly complex and time consuming. Despite the government's efforts to connect rural government offices, it seemed that the government would require a lot more time to accomplish connectivity. On the other hand, the migration of databases located in various offices, and their integration into a cloud would be achieved in less time. This integrated database would be accessible by any office at any time. This provided a clear picture of how the government could save time and cost by adopting a cloud-based implementation and integration of e-government services. To achieve the streamlined e-government service through integration the government had considered 7 milestones.

1. Procuring required bandwidth for connectivity
2. Networking among government department
3. Establishing interoperability
4. Data sharing and handling policies among the departments
5. Integration of the databases

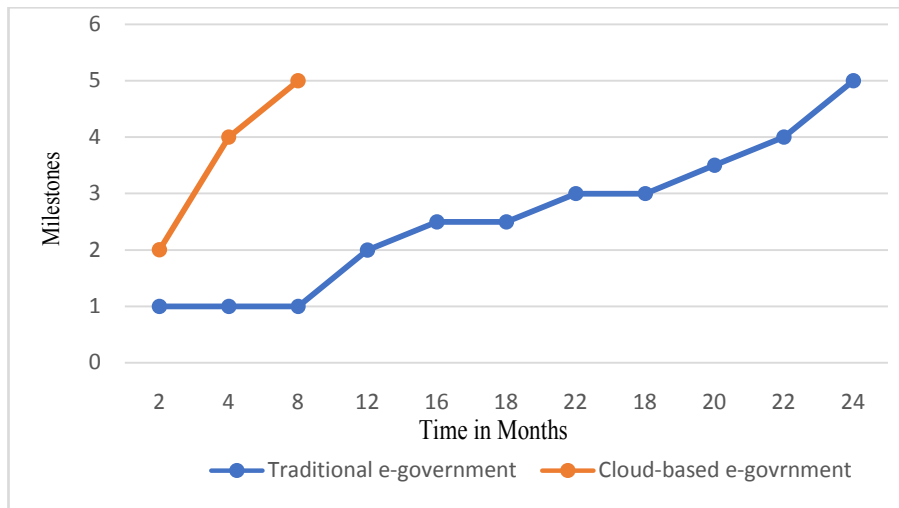


Figure 6.3: Comparison of time to implement e-government service

We have compared the time (See figure 6.3) for achieving integrated services within the traditional e-government approach and the time required in cloud-based e-government approach. We found that the government has planned to achieve integrated service in 24 months. By adopting the cloud-based e-government this could be achieved in 8 months.

Adoption Stages 1–2: Enhance Technical Skill and Trust

Technical know-how among users is the most desirable condition to achieve citizen participation. We conducted two technical workshops on how to use government services, and two seminars on the benefits of using e-government services. The workshops were conducted by the IT staff responsible for e-government services. Participants included government employees from local government offices, and residents invited through the distribution of leaflets. Workshop participants were given training on how to use the services. The participants have received basic information about the government portal, names of various government services available online, and the contact details of the help and support team.

The seminars were organized by government officials for residents to convey the e-government initiatives taken by the government, the available e-government services, the benefits of those services, and the government plan for another e-government initiative. The seminars were informative, with an hour of interactive question–and–answer sessions conducted at the end. The opinions of the participants were noted by government officials. The workshops and seminars proved a milestone in increasing the know-how of participants and the opinions and feedback from the participants helped officials to rethink how the offered services could be realigned with the citizens' needs.

Government officials found the workshops and seminars are effective in increasing the know-how among the people and decided to organize them more frequently at the local level.

Adoption Stage 3: Establish the Delivery Channels

The final task performed to achieve streamlined e-government services is to establish the delivery channels. We analyzed the probability of using various delivery channels defined by the proposed model in the given context. As the adoption of the delivery channels was subjected to availability and feasibility, those adopted in this context may not be appropriate for other countries. We assessed various delivery channels, such as tele-centers and government kiosks, which had been successfully adopted by other developing countries, such as India and Pakistan. After a brainstorming session among participants, we found that these delivery channels did not fit in the Nepali context. Therefore, after a brief discussion with government officials, we all agreed that the most feasible option is to use rural municipalities and local libraries as delivery channels for e-government services. The decision to adopt rural municipalities and local libraries as delivery channels was made based on the feedback we received from participants in a previously-conducted seminar. Most of the participants demonstrated concerns in relation to the reliability of e-government services provided through kiosks, due to a lack of the technical skills required to operate the kiosks, and potential risks of exposing sensitive information in tele-centers. Therefore, rural municipalities and local libraries are considered most effective in this context to achieve efficiency in government services delivery while providing assurance to the users for the integrity of confidentiality of their data.

6.2.5. Case study Observations

We made several observations and recorded the opinion of participants during the case study, which is presented using content analysis method in this section. We summarized the observations as described below.

Observation 1: Detailed assimilation processes brings clarity

During the case study, we had many formal and informal discussions in relation to the processes and activities defined by the maturity model. We also had discussions about the four-stage maturity model that was initially adopted by the Nepali government to

develop its e-government projects. We found that the Nepal government had not been able to achieve e-government goal in the absence of a detailed assimilation plan. The case-study participants were impressed by the detailed activities and processes defined by the proposed maturity model. They found the activities very helpful in understanding the requirement for achieving each level of maturity, and for planning the next level. “... *The activities defined by the model are supportive to the development of appropriate strategies to implement e-government services and that will save our time and effort*” (**participant 1, e-government employee**). Case-study team members from the government IT department thought that the systematically arranged activities under each stage in the proposed model brings more clarity in the implementation process. “... *The activities defined by the model are useful and support the government to pre-plan for the next stage. The pre-defined activities also save a lot of time that is required when designing implementation strategies*” (**participant 2, government IT expert**). One government employee stated that the naming of the stage, based on the service maturity rather than the technological maturity, supported the government in the comparisons between the project outcome and the aim of the e-government. Although the service maturity was the result of the applied technology, they found it easy to understand, in terms of the service delivery. “... *The stage names, based on the service maturity, will help the government assess their project based on the accomplishment of the service, and help to present the achievement to various stakeholders in non-technical terms*” (**participant 4, government employee**).

Observation 2: Streamlining services through integration improved efficiency

We found that the passport department had adopted a government-to-citizen approach of e-government implementation, where certain services (e.g., the download of application forms, submission of form online, application status checks etc.) are offered. However, no services are effective as they required the applicant to visit government offices to complete transactions. The case-study findings showed that the proposed model supported the government in achieving streamlined government services within the department. The integration of user data held in the different e-government systems located in two different district forms a consolidated service, and the service can be delivered from rural municipalities in less time and with less effort. While answering a question “*Did you achieve efficiency in the government service delivery process after implementing the proposed model*”; the case-study participants agreed that efficiency in

services delivery processes has been achieved through streamlined e-government services. The manual processing of information was eliminated, enabling government employees in rural municipalities to make immediate decisions, and to process user requests in real time. One of the aspects we considered for sustainable e-government services is efficiency, in terms of cost, time, and efforts for delivering e-government services, which is achieved by integrating the e-government system.

Observation 3: Advanced technology is essential for sustainable e-government services

We observed that the use of state-of-the-art technology to implement and deliver e-government services increased government productivity, while allowing governments to reach to the wider number of e-government service users. The proposed maturity models emphasized on adoption of state-of-the-art technology (e.g., social media presence, use of shared computing resources, use of cloud computing platform for integration and implementation of e-government services, and use of e-wallets for transaction processing). The use of state-of-the-art technology in e-government activities is found cost-effective in comparison to older technologies, supporting the financial sustainability of e-government services. The unofficial Facebook page that was set up as a part of the case study, for the administrative office of Kailali district, received more than 20,000 likes over the course of a Month. Users wrote their views, requests, and complaints about government services on the page. Furthermore, it made communication more transparent and clear between government officials and citizens. Finally, the integration of the databases of two administrative offices in the districts of Kailali and Kanchanpur was achieved by using cloud-based integration, resulting in greater efficiency. Having said that, the availability of the cloud-computing resources and the reliability of third party cloud computing infrastructure in the context of Nepal is a crucial issue. Therefore, the government needs to take an initiative to establish a cloud infrastructure and to develop appropriate laws and policies in relation to the use of private or public clouds for the delivery of e-government services.

Observation 4: Adoption stages contributed in citizen-centric e-government service

We have observed that the adoption stages defined by the sustainability-driven e-government model has supported the government to better understand the user needs and helped them to align the e-government service with their demand. Preliminary study has shown that the e-government service adoption part has been given little attention, as

such the adoption and usage ratio is very poor among the citizen. Lack of government strategy to attract people and to build trust and awareness among them to use the e-government service has failed to gain user participation. The case study findings show that the seminar and workshops conducted as part of the study has motivated the participants to use the e-government services. *“The workshops also significantly contributed to develop awareness among the participants that has resulted in the positive attitude towards using e-government services...”* (**Participant 2, government employee**).

6.3. Case study context 2: Evaluation of model assimilation approach

Department of driving licence has been selected to evaluate the sustainability-driven e-government model implementation approach. The department has its own online portal at present that allows residents of the Bagmati Zone (Nepal has 14 zones) to apply for driving licence. However, the services of the online portal only available at the office hour in Nepal that is 10 am to 5 pm and limited to a Bagmati zone. The portal allows to view the licence detail and record of a user. But all these above-mentioned services are limited for the residents of that zone. Although the driving licensing department in the different zone use their own legacy system, lack of integration and consolidated data across the departments in the different zones restrict government from providing streamlined services. Complication arises when the citizens move from one zone to another. If a person wants to apply for a driving licence from a different zone than his residence, his/her entire record needs to be requested from the zone of his/her residence and manually fed to the system of the current zone. This process takes huge time making the government services less effective and efficient. From the preliminary contacts with the people in the department, we came to know that the existing system in the department for transport and licence has been going through the reform to accommodate the changes in the recent government process following a local government body election. The department is planning to procure new hardware and software to deliver smooth government services and address the changes those have been occurring while government reformation. Therefore, we have decided to focus on the driving licencing department for the model implementation and evaluation purpose.

6.3.1. Study objective

The study objectives are;

Objective 1: *To evaluate the overall efficiency in the government process after adopting the government to government (G2G) approach.*

Objective 2: *To evaluate the adoptability and effectiveness of the cloud-computing platform for sustainable e-government services.*

6.3.2. Study plan

The study required involvement of the stakeholder from the different dimension (Government employee, ICT experts, cloud vendors and cloud computing experts) from the beginning to the end of the project. Therefore, the first task was to identify potential team member and convince them to get involved in the project. The first approach has been made to the government official in the driving licence department. We have contacted senior management employee of the ministry for an appointment to discuss about the case study. After some informal conversation over phone and via email, he agreed to have a meeting. Meanwhile the second approach has been made to the cloud service provider in Nepal. After researching for a while we have made a list of cloud service provider in Nepal those could be potential stakeholders of the project. From the initial conversation with the representative and other higher-level employee of the companies we have dropped some companies from the list as a potential stakeholder of the project as they don't fall in our criteria. (The company should be able to provide different cloud service and deployment model). After the second round of contact with the companies, we have decided to approach Data hub and network Pvt, ltd to get involve in the project. We arranged a meeting with stakeholders from both side to discuss the framework implementation plan. Data collection is done mainly from the interview, brainstorming session and observation made while implementing the cloud-based e-government and the results observed after the implementation.

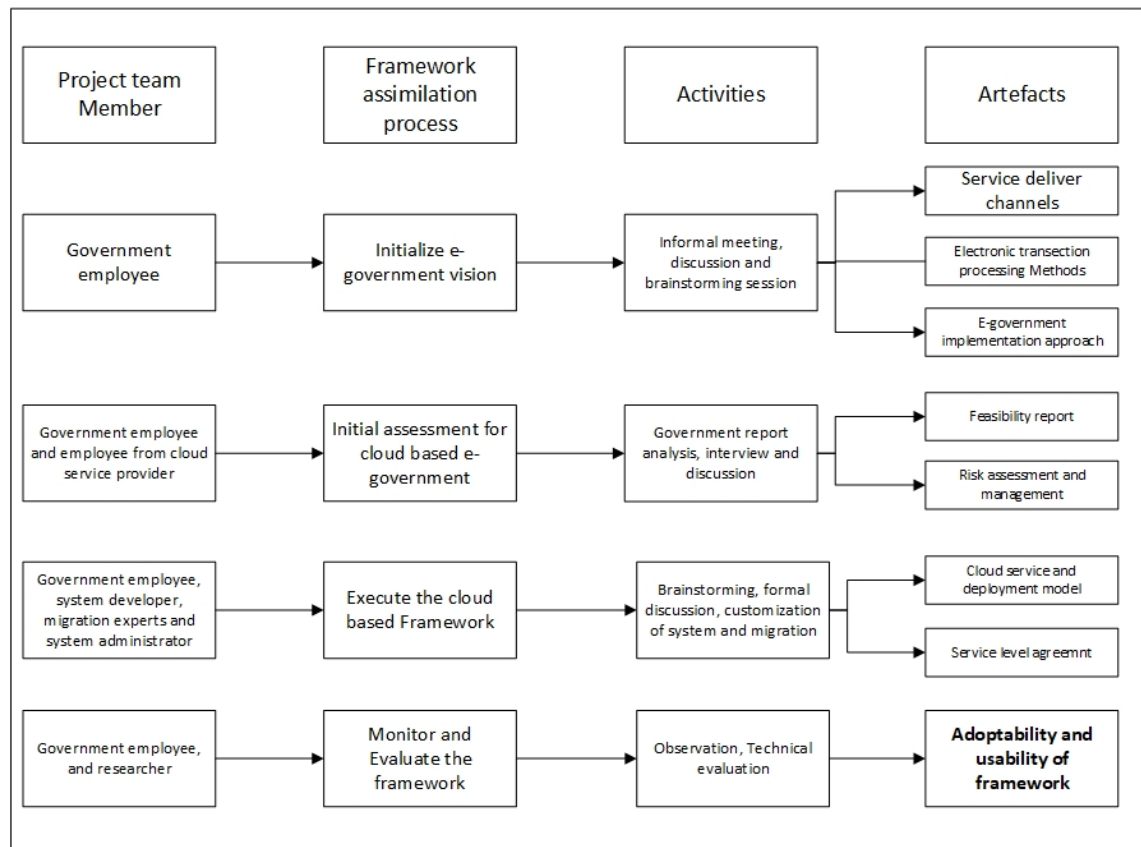


Figure 6.4: Case study Plan

6.3.3. Case-study team

We have identified the member or projects team from the different dimension. Three government officials two of them are the top-level government employee in the department of driving licence and one of the system developer from the department have been directly involved in the project from the beginning. A senior employee from the Data Hub & Network got involved in the projects and allocated 4 IT professional from his company to support the implementation process of the model. After brief introduction of the members they have been allocated their responsibility. The senior employee of Data Hub & network has taken a charge to coordinate with the senior government official in relation to the SLA and other managerial and organisational aspect of the project. IT professional from the government department and Data hub collaborated and work alongside to complete the technical part of the framework. The following roles have been allocated to the case study team member.

- **Study co-ordinator:** Senior government official, senior staff of Data hub & Network and the researcher
- **System engineer:** Government IT employee and Data hub & Network employee

- **System Administrator:** Government IT employee
- **Cloud expert:** Data hub Employee
- **Feasibility analyst and migration expert:** Data hub employee

6.3.4. Assimilation process

Since the focus of study was in a department that already has e-government services running but couldn't meet the government vision, the framework assimilation process also been customized and only required activities are executed. For this purpose, the e-government project that is in place has been thoroughly examined to decide what the government already achieved, and what is required to be done. We have gathered information that is required to implement the framework from the observation and interview season. The findings of the observation and interview were used as an input for the framework implementation.

Phase 1: initialize e-government vision

We had begun the assimilation process by identifying government vision for cloud-based e-government. An informal meeting was held with the government employee to discuss the vision for implementing the framework. Later we have taken more structured approach to gain insight into the subject domain. Semi structured interview has been conducted using loosely designed instrument to get as much information as possible. We have explained the vision of the sustainability-driven e-government model from the research perspective and encourage the participant to share their views, if they wish to add something more in the vision. The vision for adopting the proposed approach has been identified as to implement and deliver sustainable e-government services.

Once the government vision has been decided, we focused our discussion on the current e-government model adopted by Nepal, issues in the existing model and how the proposed model would address those issues. The members from the government department have agreed that the current government to citizen (G2C) approach adopted by the Nepal government is not effective in delivering streamlined services. After the brainstorming session the member of the team have agreed that in the context of Nepal, where there is no payment gateway is available, and the government services are not citizen oriented, the approach defined by the proposed model would enable government

to redesign their e-government services. The researcher explained the e-government approach proposed by the sustainability-driven e-government model in relation to the developing countries, and how government could achieve sustainability by adopting the proposed approach. To implement the approach proposed by the model we assessed the existing e-government system and services and the service delivery approach. We found that the computerization of the government offices in the rural municipalities is already on going, which is required to streamline services. We then focused the internal process of driving licence service delivery. At present the user data is held in the different zone and there is no centralized database that restrict the government department to provide streamlined service. Therefore, the government required to integrate the user data and streamline e-government application those are held in different zones. Once the integration is done the government office could speed up the service delivery process. Now it takes about 1 to 2 weeks to verify an application of driving licence with the different departments and authenticate the service request. The implementation of the framework would reduce it to the minutes or if not hours. Once the vision, maturity model and approach of the e-government implementation have decided, we have moved forward to assess how the proposed framework could be implemented. We have conducted requirement analysis and cost benefit analysis to encourage the team member by showing them how their requirements could be met in less time and cost by adopting the framework.

Activity 1: Define e-government goals

The main goal is to reduce the cost of e-government service implementation and require the ability to deploy the service rapidly saving the time.

- The technological goal is to integrate the e-government system located in the different department to provide streamlined and complete e-government services.
- Secondly the department wish to achieve the scalability and availability of the e-government services to address the increased demand from the user in peak time.

Activity 2: Requirement identification

We had conducted a semi structured interview with the driving licence department official to capture the status of the e-government system in the department and system requirements. Based on these issues the government official expects the new system should be able to meet certain requirements. Some of the requirements are given below:

- *Integration requirement:* We have found that the driving licencing department is using local area network (LAN) to communicate with its different unit in the central location and some of the zonal offices are connected through wide area Network (WAN). Running and maintain these types of network are costly and less effective. Especially when the government want to integrate the legacy system in the department offices in the different geographical area it is extremely time consuming, complex and costly. Datacentre outage because of the hardware failure and power interruption is the common problem that the department is facing. Beside this the department is struggling to management budget to cover the expanding IT expenses. Therefore, the government needs to adopt cloud-based integration services that supports to streamline e-government services in less time and cost. The department requires
- *Service delivery requirements:* The system need to integrate e-government service delivery channel to enhance service delivery. The service delivery channel shall be easy to access from any location of Nepal
- *Electronic transaction processing requirement:* Government lacks payment gateway. All the financial transactions are handled manually at the government office or people require to deposit money in the government bank account to make a licence application. The department requires integration of third party transaction handling, i.e. bank or online wallet, services within the government portal to accept the payments.
- *Security requirement:* All users' data shall keep secure including user identify detailed and payment information. The licensing services shall be available any time required by the user. The license holder can access its license information at any time.

Activity 3: Adopt the e-government approach

Define the service delivery channels

As proposed within the framework we had a meeting with the government official to discuss the proposed e-government service delivery channel. From our preliminary investigation, we have found that the 45 percent of the government service beneficiaries does not have access to the computer and internet. Similarly, 30 percent of them could not operate the computer and among them 5 percent have never seen the computer.

Therefore, different delivery channels need to be established to allow access to the services.

Following the recent election, the local government has started functioning and they have enough human resource to serve the citizen. 45 percent of the smallest local government administrative unit Rural Municipality (RM) does not have access to the computer and internet connection. Therefore, the priority for the government is to computerize the unit and connect them with the internet.

After several rounds of discussion, we all agreed that the computerization and connecting the Rural Municipalities is a best approach to delivery e-government services. Beside this the government official found it practical to establish community Tele-centres, computerization of the libraries and involving private companies to deliver services in the rural area. Later we came to know that the government of Nepal has invited foreign investment to establish the data centre in the rural area of Nepal and aim to connect the 75 districts headquarter with high speed internet.

Current practice	Agreed delivery channels
<ul style="list-style-type: none"> - e-government portal - Manual service provided from the government office (Paper based) 	<ul style="list-style-type: none"> - e-government portal - Rural municipalities - Tele-centre - Libraries

Table 6.3: Delivery channels for the e-government services

Define Electronic transaction processing methods

Since, there is no payment gateway we have approached some of the private companies to discuss how their services could be used in e-government. Among the companies E-sewa, Khalti and Pravu Bank agreed to discuss the possibility of expanding their services in e-government. E-sewa has been providing electronic wallet service to the individual and allows them to pay different types of bill i.e. internet bill, telephone bill, purchase cinema ticket and online payment to some supermarket. After the initial discussion with a senior official we have arranged another meeting that includes the government official and representative from E-sewa. The representative from the business presented their business model that shows how they process their service for small amount of commission. The commission for the handling fees for the services needs to be discussed in between the company and the driving licencing department.

The employees from the business said their company currently charge 2.5 percent commission per transection of the total amount, however this could be discussed in detail and could be reached in mutual understanding in relation to the fee handling for the government department. We have also managed to discuss the proposal with the Business development manager of Pravu bank which has been providing e-banking service to its customer. After the proposal being discussed by the government official to the board of member, they are willing to incorporate a facility to accept the driving licencing fees for their customer. The government official and bank employee agreed to have next meeting to discuss and agree the handling fee and sign a memorandum of understanding.

Stage 2: Initialise technology to support the e-government approach

Activity 1: Feasibility study

We have considered three different parameters, technological, financial and organisation in our assessment those have direct impact on the project. The analysis has supported to discover some issues those could have negative impact on the project. We have gathered data from government report in relation to their IT infrastructure, and budget allocation for the e-government systems. Than we conducted an informal discussion among the member of the project team, that involves the system designer, migration expert and government official. The cloud migration expert presented the technical requirement those need to be met to adopt the cloud-based e-government. The findings of the government report have been shared with the cloud expert and system designer to analyse whether the current systems could be migrated to the cloud. The financial feasibility has been analysed based on the outcome of the cost benefit analysis. Finally, government employee from the driving licence and the management level employee from the Data hub had a meeting to find out whether their organisational interest contradict with each other. Based on the feasibility study, we concluded that the driving licencing department have sufficient resources available to adopt the framework. Therefore, it is anticipated that the project could go ahead without any problem. The key findings of the feasibility study are shown in table 6.4.

Feasibility study report		
Parameters	Findings	Analysis
Technological	<ul style="list-style-type: none"> - Department have servers, and legacy system - Web applications are already running. 	As the department have own server and web application running, with little changes it is

	<ul style="list-style-type: none"> - Driving licence department in the different zonal headquarter have internet connectivity. 	feasible to migrate them to the cloud computing platform. As the legacy system have dependencies IaaS needs to be adopted.
Organisational	<ul style="list-style-type: none"> - Have enough human resource to involve in the project - Organisational policies do not contradict with the project aim. - Government official are keen to implement the framework. - Will gain support from the cloud provider for training the IT staff to adopt the change. - Government does not have legal framework and regulatory framework for the cloud adoption 	<p>The department have enough human resources required for cloud-based e-government. Meanwhile the change management issues is not found.</p> <p>As the government does not have legal framework in relation to the use of cloud computing, the department will make formal request to the upper level to take appropriate initiative.</p>
Financial	<ul style="list-style-type: none"> - Driving licensing department have been allocated budget for regular upgrade and maintain of their IT system. - Since the migration of the government system was only the pilot test there is no need of budget allocation. - The cloud services provider has provided estimated cost of the cloud service acquisition and the driving licensing department confirm that it is within their budget. 	The department has been allocated budget for this financial year and it will sufficiently cover the expenses of the cloud computing platform adoption.

Table 6.4: Feasibility study finding

Although the proposed framework is technically viable to implement the feasibility report shows that some of issues need to be addressed before implementing the framework. The internet connectivity is very slow; therefore, the government department needs dedicated internet connection that allows smooth communication among the system on premise and on cloud. Similarly, the department needs to procure alternative energy solution to power the in-house IT equipment and the data centre. At present the power supply to the data centre is available for limited time in a day. Having said that the above factors does not restrict the model from implementing. However, the government need to address the challenges to gain the maximum output from the proposed framework.

Cost benefit analysis

The current practice of the IT resources procurement has fixed price, and the department knows how much budget it requires to procure the government IT resources. However, lack of the certainty in relation to the cost of adopting cloud computing platform made the government official worried. This concern has been addressed by performing cost

benefit analysis that would provide comparative analysis between what the government invest and would get in return.

We have requested to the government official in finance department to provide the government budget for the e-government project and detailed the cost of hardware and software procurement, cost of maintenance and update, cost of IT staff (15 working at present) salaries and their training, and the cost of managing the datacentres that the government has incurred in one year (Table 6.5). we have found that the department spends money in procuring the distributed system as required by the different offices in the different region, lack of unified and enterprise resource planning in the department has excessively increased the expenses while delivering the very less output.

Description	Cost/month (NRs)	Cost/year (NRs)
Hardware	Rs 100,966.66	Rs 12,11,600.00
Software (Web app & other software)	Rs 58,375.00	Rs 7,00,500.00
Maintenance and upgrade	Rs 907,675.00	Rs 5,30,000.00
IT staff	Rs 451,666.66	Rs 54,20,000.00
Data centre management (servers, staff, electricity, internet etc.)	Rs 208,333.33	Rs 25,00,000.00
Total	Rs 863,508.33	Rs 1,036,2100.00

Table 6.5: Department IT spending for e-government (in Nepali currency)

Furthermore, we have requested a quote from Data hub for the proposed government services migration to the cloud and the running cost and compared those costs with the current IT spending of the department (Table 6.6).

Types of service	Estimated Cost a month	Estimated Usage	Estimated Cost a month	Estimated price a year
Virtual server	Rs 6,450.00/VPS	10 VPS	RS 64500.00	Rs 774,000.00
Cloud based integration	Rs 15000.00	-	Rs 15000.00	Rs 180,000.00
storage	Rs 25.00/Gb	2 TB	Rs 25,000.00	Rs 600,000.00
Initial cost	Rs 50,000.00			Rs 50,000.00
IT staff	Rs 30,000.00	5 staff	Rs 150,000	Rs 180,000,0.00
Total				Rs 34,040,00.00

Table 6.6: Cost estimation of cloud service adoption

We have used the template designed for cost benefit analysis and compared and analysed the adoption cost of the proposed approach over the current e-government

approach. We found that the return will be very high in relation to the monetary and non-monetary value from the proposed model. The cloud-based e-government would save the driving licencing department 68 percent of their current spending to deploy, maintain, and run their service. Meanwhile it will increase their efficiency by releasing the pressure of day to day management of the IT system, those resources could be used in some other productive work. It will reduce the server downtime and avoid the lack of service availability and risk of damaging the IT infrastructure because of the data centre power interruption. Similarly, the scalability of the computing resources would be able to handle the variation of the server loads. Another important aspect we have considered is the implementation time. Especially when the government department need to expand their services to the different geographical location, the time required to establish all the infrastructure is extremely high. Furthermore, the connectivity among these systems create another difficulty in terms of technology and cost. In contrast the expansion and reduction of the computing resources to meet the changed need of the department is almost instantaneous. Therefore, considering all the above factors, the project has high probability of success and good to go ahead.

Activity 2: Service prioritisation

The service prioritisation should be performed when there is more than one service the government needs to migrate to the cloud. This is also performed when the government starts building their e-government services from beginning. We have developed a series of questions by interviewing the domain experts (see appendix B) and compiled them to create service prioritisation template. We have designed a template (see appendix G) to record the services and their values received from the questionnaire. The government service prioritisation process uses different scales, i.e. high, medium and low ranging from 1 to 3. The sums are calculated, and the services are ranked in descending order of the sum. The service with the highest total value has high priority and the least has low.

As we have already selected a case study context that is licencing department and decided that the databases in the different location needs to be integrated for streamlining the services, and the department application server that requires scalability to handle the demand in peak hour, these two-government systems are selected for migration. The problem with the application server in the department is, it had crashed several times in past because it lacked scalability and while number concurrent users rises. Therefore, the database servers and the application server will be migrated.

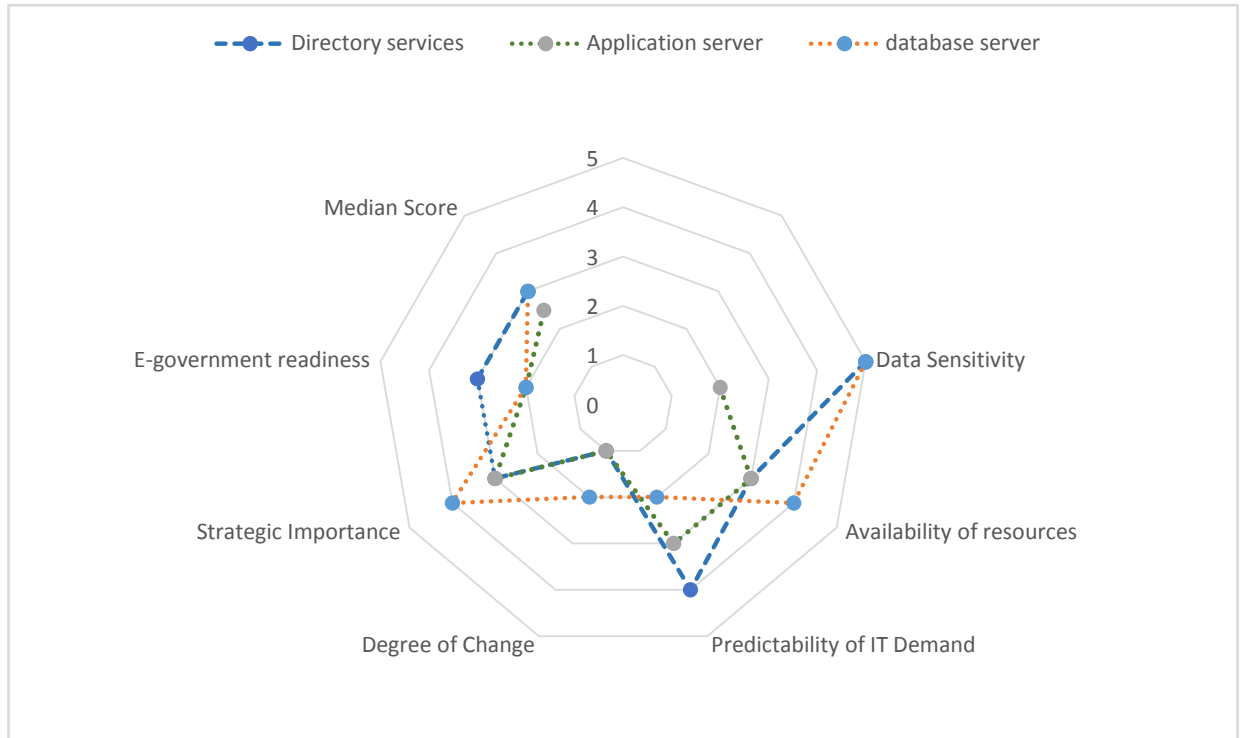
Activity 3: Adoption of cloud computing service and deployment model

After identifying the department requirement for the e-government projects we had a brief discussion session with the government employees and cloud services provider to find out the best cloud service and deployment model. We have started with assessment of the e-government system in use in the department for migration. The driving licencing department was using windows servers 2008. Two of the office in the different locations were using windows server 2003. The server needed to be replaced to accommodate the government requirement. The government official initially wanted to move file, email and application servers to the cloud and keep the database and directory service server on premise. However, there were dependencies among the server and moving part of the system to the cloud would be very complex as it would have to go through the re-configuration and networking to allow them to communicate efficiently. Only moving part of the e-government system might not perform well in the new environment, Therefore, the existing servers and the virtual machines needs to be migrated to the cloud environment. The cloud expert from Data Hub and government system architect agreed to adopt infrastructure as a service model. The Data hub agreed to train the government IT staff in relation to the day to day operation of the cloud-based system i.e. networking in cloud, security, configuration of the servers and new application etc. Until the government staffs are fully trained the day to day operation of the cloud environment would be supported by the staff of Data hub. Data Hub has also agreed to lease a dedicated high-speed internet connection to the department once they have decided to take their cloud services.

In the brainstorming season the government employee is interested to know the probability of establishing their own private cloud infrastructure. That could be shared among another department. A detailed feasibility study is required to decide whether a private cloud deployment model can be adopted. The selection of the most suitable deployment model in the research context is decided by employing adopting Cloud Deployment Selection process as shown in table 6.7 that uses 5-point Likert scale.

Deciding Factor	Directory service server	Application server	Citizen data database server
	Score < 2 (Public cloud recommended) score >2 < 3 (Hybrid), Score > 4 (Private) Based on Likert scale 1 to 5		
Data Sensitivity	5	2	5
Availability of resources	3	3	4
Predictability of IT Demand	4	3	2
Degree of Change	1	1	2

Strategic Importance	3	3	4
E-government readiness	3	2	2
Median Score	3	2.5	3

Table 6.7: Cloud deployment model selection score**Figure 6.5:** Selection of cloud deployment model

Data Hub has given an option to the government official, that whether they would like to procure all the hardware and software on the government premise and manage it for the government. However, it's not found financial feasible for the department. The other option is to have dedicated private cloud computing infrastructure allocated off premise and the legacy and some other services remain on premise. The findings of the assessment also support that the government should adopt hybrid model. Therefore, the hybrid model of the cloud is proposed for the government, where some services, i.e. application and database of the e-government will be migrated to the cloud and some of them, i.e. directory services remain on government premise.

Activity 4: Risk identification and mitigation

The feasibility report shows that with the minor changes the government department is ready to move to the cloud-based e-government. However, the government have some strict policies in relation to the privacy and security of the data and information that is being migrated to the cloud. To assure the government official of any concern in relation to the privacy, security and other issues we have conducted cloud risk

assessment. We have used European Network and Information Security Agency (2009) risk assessment framework to documents the government concern in relation to cloud computing service adoption. Table 6.8. Shows the risks identified in cloud migration in the study context.

Risk category	Risk	Risk level	Impact on the governance	Control
Organisational	Supply chain failure	High	The supply chain failure could lead to the interruption of the service as the cloud provider might have been procuring some of their service through third party.	SLA Policy
	Service termination	High	Since there are very few companies in Nepal those offer the cloud computing services and their client-tale is not significant there is always a risk of service termination.	SLA Policy
	Lock in	Medium	The data lock in situation could likely occur in the absence of an alternative service provider.	Reputable cloud provider
Technological	Data breach	High	Breach of user data could severely impact on government. User might loss trust to use the e-government services	Audit Enforce multi-layer access control Encryption Transparency
	Isolation failure	Medium	The shared resources in the cloud computing can expose the confidential data to the other tenants. Failure of the isolation of the resources could make the government system vulnerable to attack.	Reputable cloud provider SLA Adopt Virtual private cloud
	Lack of Availability	High	The government official shows concern in relation to the availability of the service.	Reputable cloud provider Back up
Legal	Violation of data privacy law	High	The measures applied in relation to the data protection by the cloud provider is difficult to check, Therefore, lack of the mechanism to check whether the provider is complying with the data protection policies, could lead to legal challenges.	Enforcement of privacy law Privacy policies
	Licensing	Low	The department yet to decide whether the software and application they are using at present might violate the terms and	Acquire software licensing

			condition by migrating them to the cloud.	
Unspecified Risk	Unauthorized access to premise	Medium	Since the data and information is not held in the government premise the official have concern over the unauthorized access to the physical location of the datacentre.	Physical security CCTV

Table 6.8: Risk assessment for cloud service adoption

Although the risk mitigation strategies have been documented in the service level agreement (SLA), some of the contingency measures have been considered for the potential risk. We have decided to acquire a virtual private cloud instead of the public cloud to minimize isolation failure issues. This would further reduce the risk of interference and unauthorized access by the intruder.

Stage 3: E-government service implementation and migration

This stage involves most of the technical details. Senior government employee and technical team of Data hub has actively involved to conduct the activities related to the migration. Security measures have been strictly followed while migrating to the cloud.

Activity 1: Initialize the e-government service migration process

Draft master service agreement (MSA) and service level agreement (SLA)

Since government work differently than the private enterprise the decision to migrate e-government services to the cloud must go through different procedure. Government has their own obligations and follow tightly guided process in relation to procure the cloud services and it has own unique requirement in relation to the cloud services those needs to be strictly met. These concerns have been addressed by drafting the Master Service Agreement (MSA) and Service level agreement (SLA).

From the beginning of the project initiation the main concern of the department official was, the security of the data and information that is being migrated to the cloud. Furthermore, the availability of the service and the elasticity for the scalability of services are the secondary concern. The government thus wanted to document the promises made in term of the service provided by the cloud services provider. After the mutual understanding among the government official and the management employee at

Data Hub a memorandum of understanding has been drafted, however it has not been signed by either of the party at this time. The service level agreement (SLA) has been drafted according the ISO/IEC 19086 that includes the following clauses as shown in table 6.9.

Clause	Description
Accountability	The clause discusses how the service provider comply with the government policy in relation to the data and information processing in the cloud.
Agility	This section provides detailed description of the elasticity and the scalability of the service as required by the department.
Assurance	Availability and reliability of cloud computing service, capacity to tolerate fault and addressing other issues when required is included under this clause.
Financial	This section provides detailed cost of migrating and running e-government services in cloud platform. It also specifies whether there would be variation in cost in future.
Performance	The performance related condition is documented under this cloud. This cover the service response time, interoperability and other cloud computing performance related subjects.
Security and privacy	All the security and privacy concern of the department and assurance from the cloud services provider have been documented under this clause. That covers safeguard of government data, keeping the privacy intact and securing the critical data from damage.
Support	This clause covers how the service provider would support the government employee throughout the migration process. This further describe the services that the department receive once the system is migrated.

Table 6.9: Clause included in service level agreement (SLA)

Cloud service provider selection

The SLA tool kit developed by Hebatalla et al., (2018) for cloud service provider selection could be used to select the cloud service vendor. This tool kit could be used when there is more than one cloud service vendor available. In the context of this research, we have pre-selected cloud vendor for their involvement in the case study.

Activity 2: Apply migration strategy

Customization and configuration of the E-government Application and system

This task runs along with the task of identifying the service and deployment model of the e-government. Members from the cloud migration expert, system administrator,

system developer and government employee are involved in this task. The existing e-government system has been assessed for its compatibility in cloud environment, the growth plan, scalability and security requirements. A third party cloud assessment tool SOASTA has been utilized to assess how the legacy system would handle the work load after it has been transformed in to web based application and migrated to the cloud. The driving licencing department web portal has been tested if it could handle the maximum potential load by simulating the load from user in different location. The web portal successfully handled hundred thousand requests at a time. Some of the basic changes needs to be done, which has been agreed among the members of the case study to gain the potential benefits of the cloud computing platform. An assessment chart has been generated with the findings of the test and recommended actions.

Select the migration type

The assessment of the legacy system performed by the cloud migration expert has suggested that the government legacy system needs to be refactoring. However, the lift-and-shift method would be more viable as the government officials have confirmed that the government is going to make more services available online and needed to replace the legacy system in near future. At this time the live migration of the e-government service did not happened rather the services are replicated and migrated to the cloud for evaluation purpose.

Activity 3: *Migrate the e-government services*

A team of cloud migration expert from Data Hub involve from the beginning of the project. We had a meeting with cloud architect, system administrator in the government department, application developers in government department and people in the finance who looks in the IT budget. The team has actively engaged in the migration process. After the initial assessment of the application by using SOASTA tool, we had used an application performance management (APM) tool Dynatrace. The reason for using the tool is, it allows 30 days of free use as a trial and seems recommended by huge number of their clients. The tool provides overall picture of the entire existing IT environment, servers, storage networking, application and dependencies among them. Than we had used Cloud Endure tools that allows replicating the e-government system, migrate it and test it before the on-premise e-government function is cut off and the services in the cloud become live. This is very crucial as we do not want to alter the exiting e-

government process, rather the purpose of the migration is to demonstrate how the proposed model can add value to the existing e-government system and address the current issues. Therefore, the deployment of the actual workload on to the cloud would be decided by the government authority in later stage.

Stage 4: Monitor and evaluation

The purpose of the stage is to make sure whether the framework has been able to meet its objective or not. The e-government services after migrating have been continuously monitored for their performance, productivity and efficiency. The outcomes have been mapped against the service level agreement and the study objective. We have made several observations in relation to the usability and adoptability of the cloud-based e-government in the study context. We found that the results have positively supported the study objectives. The government employees were interested to see whether the e-government services can deliver output according to the service level agreement after the implementation of the model, however we have been more focused on the aim and objective of the research and therefore the assessment has been done from that perspective. We have found that the model has been able to effectively integrate the isolated e-government system in less time and cost and succeeded to achieve streamlining in the services. The e-government approach proposed by the model has increased the efficiency in government services delivery process while making the services more citizen oriented.

Activity 1: Technical performance evaluation

We have used different parameters, i.e. response time, stress handling and uptime for Performance testing. We have simulated a situation as the users try to login to the online portal of driving licence department to make an application for driving licence. We have gradually increased the number of virtual user accessing the service at one time. Virtual users are created before the e-government service goes live to test whether the service will be able to handle the number of users and able to maintain the performance. We have tested with 500 concurrent requests for driving licence application and found that the system handle the request adequately.

Response time: The average response time of the portal is 290 Ms which is very good, however the response time could be affected by the internet speed at the user end. We

received average response time of 10 second while accessed the live portal with the actual service request.

Stress handling: Among the 500 concurrent virtual users, only 7 request errors have been received initially, which shows that the services has been able to handle the stress successfully.

Uptime: We ran the virtual services for 7 hours that matches office hours in a day (from 9 am to 4 pm Nepal time) in Nepal. We have achieved 90-95% of uptime. The SLA between the government and the CSP mentioned that the uptime of the e-government services will be 99% during the office hour. The CSP emphasised that the agreed uptime will be achieved once the migration is complete and live.

Activity 2: Organisational performance evaluation

We have made number of observation from the case study. For the organisational performance evaluation, we have used cost, implementation time and customer satisfaction and efficiency in the government service delivery as parameters. Although except the cost the other parameters couldn't be measured in the number we noted them by observation during the case study.

- *Cloud computing platform to support inadequate e-government infrastructure in developing countries*

We found that the cloud computing platform is a feasible option to deploy and deliver e-government services in the developing countries. While the sustainability-driven e-government model argues that the integration of the e-government service is a primary condition to deliver sustainable e-government services, the concern for the developing countries is the technological difficulties they would face while integrating the e-government services. As discussed in the context of the case study, the licensing department have several e-government system developed across the different office located in the different location, it was very complex to integrate all those systems physically. Especially when the country does not have reliable e-government infrastructure, reliable power sources, and internet connectivity, it is next to impossible to consolidate the e-government system. The case study shows that with some minor changes, the databases held in the different government office could be migrated in the cloud platform and integrated in the cloud. We found that the integration of the e-

government systems provided the complete e-government solution to its user. The complete e-government solution refers to the elimination of the manual application processing to the both user and provider's end. The citizens from the different district were able to view their licence detail, application status, and apply for new licence. Meanwhile government official could easily validate the application, see the citizen record regardless of the district they reside. This has significantly reduced error, i.e. duplicate licence issuing problem, identifying any adverse driving history of the applicant, etc. Therefore, we concluded that the approach defined by the sustainability-driven e-government maturity model (SDEGM) has successfully achieved its objective.

- *Overall efficiency in government process and increased citizen satisfaction*

The e-government approach adopted by the sustainability-driven e-government model has resulted in the increased efficiency in the government process. The government employee at the front desk have been able to save significant time while processing the citizen's request as most of the databases are integrated, and required information is available to them. The employee could verify the application without having directly contacting the different district office, via phone, email or fax that was being used before. This has also contributed in the citizen satisfaction as their service request time has been significant reduced. The paper-based application was time consuming and would takes hours to complete. The government to government (G2G) approach has saved their time and cost. Therefore, the approach has supported the objective of the case study.

6.4.Survey

The previous section has performed two case studies to evaluate the implementation determinants and the overall approach. As the sustainability is achieved through effective implementation and wider adoption of the e-government services, the adoption determinants also need to evaluate. Note that the adoption determiners need to evaluate from the user point of view and the survey presented in this section uses for this purpose. The survey is from the same geographical context as the case study. The objectives of the survey are

- *Objective 1: To evaluate the impact of Agile accessibility in sustainable e-government services.*

- **Objective 2:** To evaluate the *impact of trust and awareness in sustainable e-government services*.

6.4.1. *Survey construct*

The construct of the survey has been designed based on the three adoption determinants, i.e. agile accessibility, trust and awareness. The constructs are the variable those impact on the sustainability of the e-government services from the user adoption perspectives.

- **Construct 1:** The more access channels are available the more likely users adopt the services;
- **Construct 2:** User trust is essential for wider adoption of the e-government services;
- **Construct 3:** User awareness could support wider adoption of the e-government services

The questionnaire consisted of both open and closed questions and took approximately 45 min to complete. Six general, and twenty-four objective questions were asked. A psychometric scale ranging from 1 to 5 was utilized to ascertain the participants' views on various aspects.

6.4.2. *Sample selection*

Stratified random sampling was employed to select the sample size. Stratified random sampling is used when there are multiple subsets or groups within a population, allowing sample sizes to proportionately represent the population. As the researcher wanted to assess how users from the different dimension of the society reacts on the usefulness of the e-government services those were implemented using sustainability-driven approaches.

6.4.3. *Sample size*

It is imperative to select appropriate sample size to correctly represent the population or to generalize the research findings (Kotrlik et al., 2001). There are different views on the sample size of the populations. Hill (1998) said that it is general conception that the large sample size well represents the population, however this is not the only deciding factors. Comparatively small sample size could equally reliable, if the appropriate measures have been taken while selecting the sample size. The researcher has followed

the criteria for sample selection as discussed by Israel (1992). The researcher has kept level of precision at $\pm 5\%$, while keeping the confidence level at 95%. Similarly, the degree of variability has been kept at .5, which is regarded as the fair variation. While applying the equation for the above figures;

$$\begin{aligned} \text{Sample size } n_0 &= \frac{Z^2 pq}{e^2} \\ &= \frac{(1.96)^2 (.5) (.5)}{(.05)^2} \\ &= 384 \end{aligned}$$

Therefore, the ideal sample size would be 384. The research has selected the sample size of 400 which is above the ideal size.

6.4.4. Pilot testing

Pilot test act as a feasibility analysis of the tools used to conduct survey research. Pilot test is done to define internal validity of the instrument used in the survey (Dikko, 2016). Epstein et al., (2015) says pilot testing provides an opportunity for the researcher to understand how participants react and answer the questionnaire. To improve and correct any mistakes, the designed questioners were tested on 5 colleagues and researcher. After the feedback received from the pilot test, the layout and order of the questionnaire was changed as deemed appropriate.

6.4.5. Survey Context

Nepal, one of the developing countries in South Asia, was selected for the survey. The Nepali government initiated the electronic government project in 2008 with the aims of minimizing corruption and better aligning government services to meet the needs of stakeholders. Although it was quite some time since the plan was announced, only a few projects had been completed thus far, among them the Nepali government's tax payer's portal, the portal for business licenses, and a service for passport applications. However, several constraints, such as access to technology, quality of service, and awareness and trust limited citizen participation in these e-government activities. Therefore, the survey aims to analyses the difference in the e-government service adoption decision among

the users before and after the implementation of the sustainability-driven e-government model.

The survey was conducted on 200 university students and 200 residents of a city, both of whom were relatively familiar with technology. Participants were at least 18 years old, had basic IT skills, and had completed secondary education. The researcher considered participants who had recently used e-government services for passport and license applications. In total, 380 responses were received, of which 370 were valid. Ten questionnaires were discarded as invalid (not completed or not answered correctly). As such, 370 questionnaires were used for the final analysis. Table 6.10 shows the number of respondents to the survey.

Description	Number
Total number of participants	400
University students	200
Residents	200
Valid responses	370
Invalid responses	10

Table 6.10: Survey respondent statistics.

6.4.6. Survey Findings

The survey findings are presented in two separate sections as two separate approaches of data analysis has been used.

Subjective data analysis

The subjective questionnaire provided rich insight of users' opinions on sustainable e-government services. Frequency analysis brought forward some interesting findings on the use of e-government services and the access to the ICT tools, prior to the proposed model being implemented.

Description	Numbers
Participants own computer	50
Participants own smart phone	80
Participants know about e-government services	20
Participants have access to the internet	45

Table 6.11: Participants using ICT tools and having awareness.

Among the various factors which influence users' behavior and their intentions to adopt the electronic government, accessibility to e-government services emerged as the most critical factor (see table 6.11). Only 50 participants of the 370 own a computer, while 80 participants own smart phones. 45 participants have access to the internet, with only 20 participants know about e-government services. Based on the facts that only a few people having access to the technology, it is not unreasonable to think that this is the primary reason as to why adoption of e-government services is unsuccessful in developing countries. After the implementation of the proposed model, the participants' opinions have been changed significantly. The variance in the adoption of the e-government prior to implementation and after implementation of the model is presented in table 6.12.

Adopted the E-Government (Yes/No)	Before the Implementation of the Maturity Model	After Implementation of the Maturity Model
YES	19	351
NO	330	40

Table 6.12. Variation in the adoption of e-government services.

The findings of the subjective questions have been arranged into three different themes usability, trust and awareness, and quality of services. Keywords have been picked from the answers, i.e. lack of trust, lack of access to technology, lack of awareness, and poor quality of information, which were frequently used in the responses. These keywords were used as categories of user opinions across the themes for analysis.

Theme 1: Usability of the e-government services

While answering a question *“How do you describe the quality of the e-government services prior and after the implementation of the sustainability-driven e-government model?”* most of the participants of the survey have expressed their concern in relation to the usability of the e-government services. The participants found that the e-government services did not improve the process of the service adoption prior to the model implementation. Because of incomplete service and lack of the streamlining of the information and system, the user must go through manual process of obtaining service at some point. Usability of the services comes with the accessibility to the services. The participants found it difficult to access the services as it did not facilitate the users who does not have access to the information communication technology. The department has

established the e-government portal however does not provide accessibility channels for the users to access the services. The participants found that the e-government services have become more usable since the model has been implemented. The participants agreed that because e-government services are now more easily accessible, they are more likely to use them. Most of the participants agreed that the application validation processes took less time now. Various access points for the delivery of e-government services (local government offices and libraries) made it easy to access e-government services for participants who did not have access to a computer and the internet. They further suggested that an increase in the number of delivery channels (e.g., mobile e-government service stations, kiosks, and community centers) would be highly effective in the local community.

Theme 2: Trust and awareness

Trust and awareness played crucial role in the user decision to adopt the e-government services after the implementation of the model. The trust of the online transaction system had a huge impact on citizens' intentions of using the electronic government. Prior to the implementation of the maturity model, participants found that, most of the time, online transactions returned as invalid, meaning the process had to be restarted. In most cases, they must complete the service request process by visiting the government office. Moreover, some of the (age group of 45–55 years old) participants have strong ties with government officials, with whom they had built good relationships over the years, and with whom they feel more confident when getting the services in person.

Participants found that government initiatives to build trust through various campaigns and through the introduction of various laws ensuring the security and privacy of online transactions is significant. Furthermore, ICT workshops conducted by the government in the local community are also helping to develop trust among people of using e-government services. An online presence through social media (a Facebook page and tweeter handle of the local government body) acquired huge popularity among e-government service users. Participants found that government Facebook pages and Twitter accounts are great sources of information on government activities. However, participants raised concerns in relation to the content and quality on the government portal. Some of the participants found that poor quality of e-government services discouraged them from using those services. Therefore, while answering a question “*What does the government need to do, to make e-government services accessible and*

reliable? they stressed that trust come from the quality of service, therefore, quality of service need to be maintained.

Theme 3: Quality of information

Quality was defined as the quality of information, its relevance, response time, and the availability of help and support. However, this was lacking in the context of developing countries. While answering a question “*What are the problems you have faced while using the e-government services prior the implementation of sustainability-driven e-government model?*” participants said that the government websites are not compatible with smart phones and tablets. The websites are designed to be viewed on certain devices, with browsers limiting non-computer users from accessing the services. Participants agreed that device-independent and smart-phone-friendly designs would encourage users to access online services. Some of the participants found that a lack of language selections on the government website made it hard to use. Most of the computing terms are in English, and when translated into the local language (Nepali), does not provide meaningful definition. For example, the government’s tax payer’s portal only accepts Nepali language when inputting user data. Participants agreed that allowing language selection would help users use their preferred languages. However, they found that the web applications are complex as abbreviations used on the website are not properly described, contents are poorly maintained and managed, and the interface is not user-friendly. Some participants stopped using the e-government web application after a couple of times as there was no help available when needed. The websites neither offered technical support, nor was there any dedicated customer support available. Participants were more likely to use e-government services if these issues were addressed.

Descriptive statistic

- *Survey participants response rate*

The table 6.13 shows the response rate of the participants for the different instrument.

Survey		Survey instrument	Measurement Scale				
			1	2	3	4	5
Agile		E-government services are easily accessible to me and the people live around me.	15 %	10 %	4%	58 %	13 %

		The current effort put by the government for e-government services delivery is sufficient.	31%	8%	1%	45%	5%
		The proposed e-government services delivery channels are useful and would enable me to access the services conveniently.	1.5%	3%	1%	65.5%	29%
		Getting service from the government office is easier than adopting e-government service	2%	5%	3%	58%	32%
		I will use the e-government services if they are easily accessible.	1%	0.5%	2%	48%	48.5%
	Trust	I have trust on the e-government services offered by the government	2%	5%	4%	51%	38%
		The e-government services offered by the government are reliable.	4%	8%	1%	47%	40%
		I prefer using government services manually than online because I think the online services are not secure.	6%	2%	4%	52%	36%
		I think trust on the e-government services has influence my decision to adopt the e-government services	1%	5%	2.5%	37%	55.5%
	Awareness	I am aware of the e-government services offered by the government	6%	2%	5%	47%	40%
		The workshop, seminar and training offered by the government to enhance the skills are helpful in adopting e-government services	1%	5%	6.5%	30%	57.5%
		If the e-government services are reliable, trustworthy and beneficial, I will use them in future.	2%	1%	3%	20%	74%
		Awareness on the e-government services has changed my decision on adoption of the services	3.5%	2.4%	2%	38.1%	54%
		The government efforts to develop awareness in our community are sufficient	20%	38%	12%	25%	5%
		If the government provide appropriate training and support I would prefer using e-government service in future	2%	3.5%	6%	35.5%	53%
1: strongly disagree, 2: Disagree, 3: Neutral. 4: Agree, 5: Strongly agree							

Table 6.13: Response rate of survey participant

The response rate shows that most of the participants agree or strongly agree on the usefulness of the e-government services after the sustainability-driven e-government maturity model (SDEGM) has been implemented. It also shows that the participants found the government efforts are not sufficient to make the service available, Therefore, the government need to work towards establishing more delivery channels. The table also shows that most of the participants agreed on adopting e-government services, if they have more access channels, and government put effort to develop skill among them.

- *E-government adoption pattern between students and residence*

The table 6.14 shows the pattern of e-government adoption between the student and residence.

Participants	Number of participant	Valid response	Adopted e-government	
			Yes	No
Students	200	190	183	7
Residences	200	180	168	12
Total	400	370	351	19

Table 6.14: E-government adoption pattern

We have performed person's chi-square test at significant level of <0.05 to evaluate, whether there exists any significant pattern of e-government service adoption between student and residence.

	Pearson's chi-square test		
	Adopt	No adopt	
Students	183 180.24 (0.04)	7 9.76 (0.78)	190
Residences	168 170.76 (0.04)	12 9.24 (0.82)	180
	351	19	370

$$\chi^2 = 1.688, \quad df = 1, \quad \chi^2/df = 1.69, \quad P(\chi^2 > 1.688) = 0.1939$$

Table 6.15: Person's chi-square test

The calculation of the chi-square as shown in table 6.15 returned the p value grater then significant level (<0.05). Therefore, we can conclude that there is no significant difference in e-government service adoption pattern among the student and residence.

6.4.7. Reliability of the construct

Cronbach's coefficient alpha value has been tested for the instruments used in the survey to assess their reliability. Cronbach's is used to identify the internal consistency

among the instrument used in the research. The reliability test has shown the construct and instrument under those constructs have performed well. The construct and instrument are found consistent. Therefore, the study performed by using the instruments is reliable. Tavakol & Dennick (2011) said the alpha value decide the reliability of the construct. The acceptable value of the alpha is between: 0.70 to 0.95 (Gliem & Gliem, 2003).

Construct	Number item tested	Total number of cases	Valid cases	Cronbach's coefficient alpha	reliability	Variable
Accessibility	5	370	365	0.891	High	Independent
Trust	5	370	367	0.922	High	Independent
Awareness	6	370	363	0.878	High	Independent

Table 6.16: Reliability test result

The above table 6.16 shows that the internal reliability of the construct used in the survey. The alpha value of the three construct is more than .70 which is considered to have high reliability. There were five instruments under the construct accessibility. Total 370 respondents have completed the questions of which 365 were valid and analysed for internal consistency that retrieved alpha value of .89. The construct trust has 5 instruments and 367 valid responses have been received from total of 370 respondent. The analysis has retrieved the alpha value of .92 which shows excellent reliability. Finally, six instruments have been used under awareness, and total 363 valid responses have been received. The instrument achieved reliability of 0.87 which is above the acceptable value. Therefore, the reliability of the instrument used has been achieved.

6.4.8. Regression analysis

The GNU PSPP 1.0 software has been used to categorized and document responses for statistical data analysis. A multiple regression analysis was performed to examine the impact of independent variables (agile accessibility and trust/awareness) on the dependent variable (users' intentions of adopting e-government services). Table 6.18 shows the results of the regression analysis. Total of 370 valid responses received from survey participants have been analyzed. The analyzed cases resulted in significant

findings that supported the objectives. As shown in table 6.17, the adjusted R-squared value represented the level of variation in the dependent variable upon changing the independent variable. The regression analysis showed that the adjusted R-squared value was 95.8%, proving the decision to adopt e-government services is highly dependent on agile accessibility, trust, and awareness, whereas the remaining 4.2% of decisions were influenced by other factors.

Regression Analysis	
Adjusted R-Squared	0.95863531
Standard Error	0.37817496
Observations	370

Table 6.17: Initial regression analysis

The regression analysis presented in Table 6.18 shows that all three independent variables - agile accessibility ($p < 0.005$), trust ($p < 0.009$), and awareness ($p < 0.009$)—had significant values. The variables were considered significant, and as having an impact on the dependent variable when the p -value was lower than 0.05. Thus, the retrieved p -values of less than 0.05 proved that agile accessibility, trust, and awareness have positive contribution in users' decisions to adopt e-government services. The analysis also suggested that agile accessibility had the most significant impact ($R^2 = 0.164$) on user decision, followed by awareness ($R^2 = 0.139$), and trust ($R^2 = 0.078$).

	R^2	Standard Error	t -Statistic	p -Value
Intercept	0.811	0.36879	2.20169	0.028
Agile accessibility	0.164	0.058152	2.82966	0.005
Trust	0.078	0.030195	2.605863	0.009
Awareness	0.139	0.053355	2.606809	0.009

Table 6.18: Further regression analysis.

6.5.Expert opinion

At this stage, the evaluation completed the case studies and survey. The results are also analysed. However, it is necessary to generalise our findings based on the observation from the case studies and survey. Expert opinion is used for this purpose. The expert opinion follows two rounds Delphi iteration as shown in Figure 6.6. To avoid the systematic bias arising from single source of data the experts have been selected from different domain, i.e. government official involved in e-government implementation, policy makers, e-government system experts, government IT staffs and independent

researcher. Delphi participants include 5 members from government employee working in the electronic government project implementation department, 5 government employees working in policy making level, 5 government employees working in government IT department, 5 cloud experts and 5 researchers in e-government. This will balance the opinion of the different stakeholders those are involved in the electronic government implementation and adoption activities.

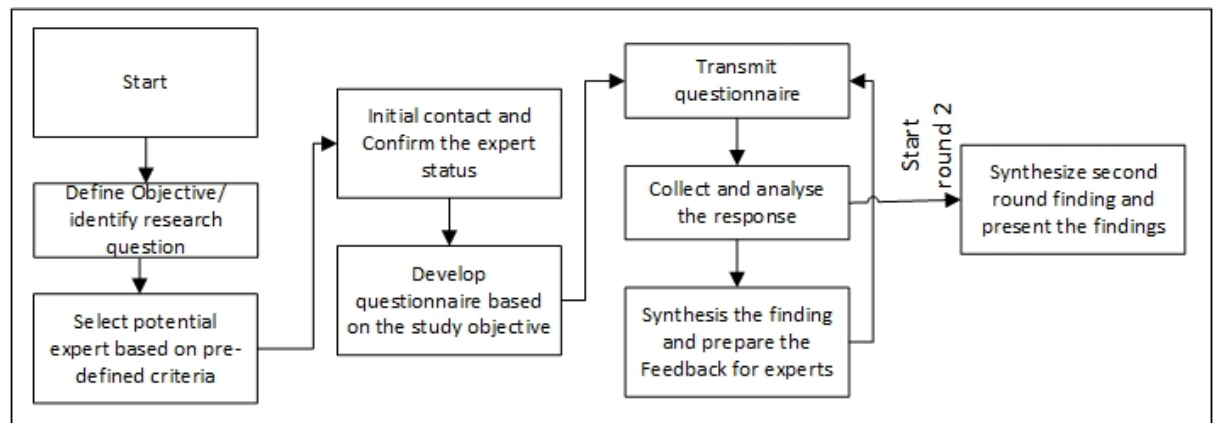


Figure 6.6: Expert opinion using Delphi

Electronic questionnaire with a covering letter has been used in the first round of the Delphi to acquire the participator's opinion in relation to the proposed maturity model for its relevance in designing sustainable e-government services. Brief introductions of the proposed maturity model and its stages have been defined briefly in the cover letter. The defined determinants have been explained and they have been justified against the limitations in the exiting e-government maturity model. The rationales for the proposed maturity model and its applicability in designing sustainable e-government services in the context of developing countries has been described through the cover letter. Respondent validation (Member check) technique has been used to assess the internal validity of the interview questionnaire. The respondent of each group has been provided with the Summary of synthesised responses from the first round to allow them to rethink on their opinion. This has resulted in the change in 2 answers from the government employee and 2 from the e-government IT expert. Content analysis technique has been used to present the information obtained from the Delphi method. The questionnaire contented both ideal (asking about the opinion) what the challenges are faced by the government while implementing e-government services?, Leading

(Comparing two cases) do you think the proposed model would enhance the efficiency in the government process, and objective question.

6.5.2. *Study construct*

The researcher has considered three main criteria to develop the study construct. The construct of the study has been designed based on the study aim and objective. Design of appropriate construct in research is vital as it guides the study in the right direction. The focus of the overall construct of this study is to analyse the impact of the implementation determinants in designing sustainable e-government services. The construct of the Delphi summarised in this section.

- *Detailed assimilation process*

The aim of the construct is to seek opinion of participants on the assimilation process defined by the proposed model for designing sustainable e-government services. As exiting maturity model lack the detailed process, this construct focus how inclusion of the assimilation stage makes maturity relevant for sustainable e-government service design. Especially the construct has been used to analyse the impact of including the assimilation process in government process efficiency.

- *Government to government (G2G) approach for streamlined services*

The aim of the construct is to justify the arrangement of integration stage before the transaction stage for the streamlined services. The construct focuses on the impact of integration of the e-government systems to gain efficiency in the government process. Furthermore, the construct will be used to analyse the expert opinion, how the integrations could be achieved in less time and cost.

- *Use of state-of-the-art technology for e-government implementation and integration*

The aim of this construct is to seek the impact of using state of the art technology in designing and delivering sustainable e-government services. The construct focuses on how inclusion of the state-of-the-art technology in this case cloud-computing for integration would support the government achieve streamlined e-government services in the developing countries.

6.5.3. *Expert opinion findings*

We have employed content analysis technique to analyse and present the findings of the expert opinion. Content analysis is used in the qualitative research to categorize, classify and summarize the qualitative data and information (Neuendorf 2016). Interpretive approach has been used to synthesise the answers and present the finding. We have arranged the data received from the interview in the different themes. The most relevant opinion of the respondent has been quoted. Almost all the participants from the all three dimensions (government employee-beneficiaries-IT expert) agree that the integration of the electronic government system in the different level of the government is crucial for the citizen-centric electronic government service delivery. The participants from the government employee and IT expert have found that the proposed model would be viable, effective and can serve as an alternative approach to assimilate the e-government project successfully.

i. Usability of the proposed approach

The participants have found that the proposed e-government assimilation approach could be efficient for both the government and stakeholders. The participant agreed that the countries not having payment gateway less likely to be benefited from the G2C government approach. Therefore, they agreed that the assimilation model needs to be redesigned in the context of the developing countries. The participants from the research study group have mostly agreed that the integration of the government department is most important in developing countries to deliver government services efficiently. The government official agreed that although they have launched department portal to encourage the citizen take the services online, there is very less activities noticed online. This has not helped the government department to minimize the workload they are facing at office. They found that the integration of the government department before the transaction stage could make their work much easier. The e-government user found that the G2C services offered by the government are not efficient and agreed that the proposed model would allow them to acquire the government services in more effective and efficient manner. As the proposed model defines various service delivery channel, it could accommodate the demand of the user with the different ability. “.. *need to walk hours to the district office to get certain service those can't be provided at local office, the proposed model has identified different service adoption channels, if they are*

implemented, that would save our time and cost to travel to the district government offices... (Participant 11, E-gov user)”.

Although the government employee from the e-government projects agreed that the integration of the government department would increase the work efficiency, they have shown some concern in relation to achieving the integration. “... *Within the available ICT infrastructure, the integration of the government department is not realistic(participant 9, government employee)*”. The concerns have been addressed in second round of Delphi. We have summarized the various integration technique and option available to comprehend the inadequate ICT infrastructure. Once the participants have been provided with the detail about the integration technique, they agreed that proposed model would address their concern. some of the participant from the e-government beneficiaries have found the proposed model provide more efficient approach for them to communicate with the government as the initial stage propose having website along with the social media presence. They said they look at the social media to get most day to day information such as news, incidents, political activities and programs around them. Therefore, the inclusion of the social media activities at the initial stage greatly supports government to prepare for the future e-government services.

ii. Government services efficiency

While answering a question “*How does the e-government approach adopted by the sustainability-driven e-government model would contribute in streamlining e-government service in developing countries?*”;The participants saidthat the proposed model would allow the government to provide streamlined services by avoiding the manual interaction that takes place among the government department in the different level. The integration of the government departments at the initial stage removes the communication gap among the government offices and allows government employee to make appropriate decision in less time. “...*key factor in government services being less effective is the decision-making process that occurs in hierarchy. The communication among the government department takes significant amount time. Streamlining the government department would allow us to provide immediate decision in service delivery (Participant 8, government employee)*”. Another significant finding received from the study is that the model would support the government to address the data replication problem. In Nepali context the data silos and individual system scattered around the different geographical

location has resulted in the data replication. The data and information first fed in to the local system than it must be migrated to the central or regional system if required. The employee believes that the proposed model would solve this problem by integrating the government department that would allow the data to be fed to the central data base and all the government department could access when required. “...*data and information feeding in the different system at different level at different time have resulted in the huge replication problem. The proposed system would help to minimize the replication error (Participant 1, government employee)*”.

iii. E-government implementation cost

While answering a question “*is the technological approach defined by the sustainability-driven e-government maturity model (SDEGM) viable for implementing and streamlining e-government services in developing countries;*” the government officials expressed their opinion in relation to the cost of e-government implementation. One of the reason they described the slow pace of e-government project development is the lack of budget. While they have been provided the cost benefit analysis from the case study they agreed that the government would significantly save the e-government project cost and rapidly move towards the advancement. ” *running cost of the individual and individual data bases and application in the different government department is high, the integrated system would help to reduce the cot required to establish and run individual system...*” (**Participants 4, government employee**). The officials at the local government are confident that the proposed model would save the service delivery time allowing them to save cost and increase productivity. They found not only the government department cost will be saved but also the model would be able to minimize the service adoption cost. The IT expert has the same view in relation to the proposed model. “...*Government of Nepal has limited budget for e-government project. Most of the e-government projects are funded by foreign aid and loan. Therefore, the government could not afford to invest to establish individual system in every local government authority. The integration of the government department and establishing centralized database for the particular government department would be huge relief for the government (Participant 5, IT expert)*. While integration of the government department would saves procuring and managing cost of IT infrastructure, the user would be benefited from the timely and effective services.

iv. E-government implementation approach

The government employee agreed that the government of Nepal is not yet ready for G2C services although it has already rolled out some of the government service for the citizen use. “.. *Government needs to do a lot to increase the citizen participation in the e-government services. Government has to establish proper channel of services delivery and educate people, establish sufficient ICT infrastructure from both implementation and adoption perspective (Participant 2, government employee)*”. The government employee also confirmed that the government has realized that the G2C approach of the e-government is not suitable for the Nepal in the current scenario. “...*the proposed model of the e-government assimilation would support the government to better prepare before the government provide complete online services (Participant 7, government employee)*.” The participants from the government employee and IT expert have expressed their opinion in the current e-government services offered by the Nepal government. “... *The usability of the current e-government service is next to nothing. Very few stakeholders use the online services. The government offices are still struggling to provide the government services as the people are reluctant to use the online services (Participant 3, government employee)*. Therefore, the participants believe the proposed model would better prepare the government to offer G2C services.

v. Integrated e-government services

The participants from all the dimension have agreed that the existing e-government approach in Nepali context is less likely to be successful. The government employee from the department confirmed that the government services being offered online are either need secondary verification or needs to visit government office to complete the transaction in absence of the system integration among the departments. The cloud experts stressed that the cloud-based integration would be feasible in relation to the Nepali context as the government lacks infrastructural and financial adequacy. However, some of the IT expert have different view on the automation of the government services. To achieve a complete automation of the e-government services, government need to do more than just integration of the government department. “...*E-government service could be achieved, in terms of the verifying application, payment processing and getting certain services online, however the automation of the services has broad meaning. The automated government services i.e. automatic reminder for the service renewal, automatic notification of the service update, user involvement in the*

government decision making only could be achieved if both vertical and horizontal integration has been achieved (Participant 10, IT expert)."

The participants said that the two-stage verification (user needs to take the original documents to the government office to verify), takes more time and effort to complete the online service taking process. *"...more complex than the manual services, and the services do not offer complete online solution. It's comparatively easy to take services directly from the government offices (Participant 6, e-gov user).* While asking a question *"How does streamlined e-government services would contribute in citizen satisfaction?";* the participants said that the streamlined e-government services proposed by the SDEGM will integrate the services at different level thus would provide complete e-government services anywhere anytime, that will results in the time and cost saving for the beneficiaries. Therefore, it would results in a greater customer satisfaction and wider adoption of the e-government services.

6.6.Summary

The chapter has presented the research findings retrieved from the different research methods. Case-study, survey and expert opinion has been adopted to evaluate the proposed model. The case study has evaluated the implementation determinants and the e-government implementation approach for its impact on the design and delivery of the sustainable e-government services. The findings of the case study show that the implementation determinants played crucial role in bringing efficiency in the government process by saving the time and cost of e-government implementation. Moreover, the assimilation process defined by the maturity model and the approach that the model has proposed for implementation of the e-government in the developing countries has positively contributed in delivering sustainable e-government services. Cloud-computing has been successfully adopted for implementing and integrating e-government services that contributed in delivering streamlined services.

The survey has been used to evaluate the adoption determinants and the user adoption of the e-government services after the model implementation. The service delivery channels, and electronic transaction methods have been successfully integrated in the e-government services. The users found that e-government services are more user centric, complete and reliable after the implementation of the model. The findings also show that there is significance increase in the user adoption of the e-government services after

the implementation of the proposed model. New adoption determinants “quality of service” has been surfaced after the survey. The survey findings show that along with the trust, awareness, and ease of access to the e-government services, quality of the services influence their decision to adopt them. Poor quality of the information presented in the portal, help and support to use the online services needs to be addressed to achieve sustainability of the services.

Finally, the expert opinion has been used to generalize the findings received from the previous evaluation methods. The expert opinion confirmed that the proposed model would support the governments in the developing countries to achieve e-government sustainability. The findings show that the e-government implementation approach and adoption strategies provided by the proposed model have significant importance in design and development of the e-government services.

Chapter

This chapter provides an overall discussion on the research findings. The discussion is focused on how the research findings have supported the research aim and objectives and how the researcher questions have been adequately answered. Furthermore, the chapter will also highlight the new determinant of the sustainable e-government services that is identified while implementing the model. Based on the findings the chapter revise the activities and accommodate the determinant in the model.

7.1. Background

The analysis and discussion on the key findings are based on the research aim and objectives. The proposed research has successfully evaluated and validated the sustainability-driven e-government maturity model (SDEGM) in the context of Nepal.

One of the key outcomes of the study is the identification of determinants for the sustainable e-government services. From the initial literature review, the researcher has found that the existing e-government maturity models have several flaws those are adversely impacting the sustainability of the e-government project. Based on the limitations the researcher has defined the determinants and used them to design a new maturity model that support governments in the developing countries to design and deliver sustainable e-government services. One of the issues in the sustainability of the e-government service in developing country is poor adoption rate. The findings of the case study and survey in the context of Nepal also shows that the adoption of the offered e-government services is very poor. The study findings show that the user decision to adopt e-government services have been significantly increased after the implementation of the proposed model. We have also found that the of Government to government (G2G) approach proposed by the sustainability-driven e-government maturity model (SDEGM) has contributed in delivering streamlined e-government services, that has increased user satisfaction while saving government time and cost. The brief discussion on the findings of the data at each stage has been presented in the following sections.

7.2. Discussion about case study findings

The case-studies have been used to evaluate the sustainability of the e-government services from the implementation (government) perspectives. The objectives of the case studies were to analyse whether the proposed model will be able to streamline government services by adopting cloud computing platform, while achieving better efficiency in relation to the cost and e-government service implementation time. The interview, observation and technological analysis by using different tools for technical efficiency assessment of the cloud-based e-government services have provided a rich understanding in how the proposed model supported the government to achieve its vision.

- ***Sustainability from technical perspective:*** Technological sustainability is related to the technology used to implement and deliver the e-government services. The proposed model has identified cloud computing as a potential platform for implementing and integrating e-government services in the context of the developing countries. The case study results clearly supported that the cloud computing platform is the most appropriate technology to implement e-government services in the context of Nepal. The preliminary investigation results observed that Nepal has adopted four stage e-government maturity model, and since the initiative has been launched in 2008, it has achieved only the first stage of it. The case study shows that only few number of users used to access the e-government services, also the offered services have limited features. Different government department have established their own legacy system to make their work easy in the department. Networking and physical integration of the among those department is almost impossible, as they reside in the different geographical location and it will be very expensive and complex task to integrate them physically. The case study findings show that the licencing and passport Department successfully integrate the databases located in the different districts. The government services have been made available 24X7 which was not the case before because of the power shortage. The security of the government systems has been ensured in the cloud by cloud service provider. The data centres are not adequate in Nepal, no reliable internet connectivity is available in the remote areas, and in this context the cloud computing infrastructure has greatly supported the e-government service implementation.
- ***Organisational Sustainability:*** Organisational sustainability is related to the efficiency in the government process, i.e. time of service delivery, customer satisfaction and cost of e-government services implementation. The case study participants from the government department have found that the model has brought efficiency in the government process. The time of the service implementation and service delivery has been significantly reduced by adopting the model. As most of the technological aspect have been managed by the cloud computing service provider, government employees have been able to focus in the quality of the service. One of the important findings is the efficiency achieved in the e-government service implementation process. Nepal government had started the e-government initiative in 2008, unfortunately there is no significant progress had been made after the initiation. The model has supported the government

employee, to deploy and integrate the e-government service in less time with high accuracy. The stages and activities defined by the model has supported the government employee to make appropriate strategies to deploy the e-government services in the different context. We have observed that the cost benefit analysis findings show the government has been able to save substantial amount of money by using cloud-based e-government that ensures the organisational sustainability. The findings show that the government department have been spending a significant amount of budget in managing the hardware and software and hiring IT staff for this purpose. Moreover, the government have been spending huge amount of budget every year to upgrade the old hardware and software. This has been reduced by more than 68 percent. Thus, the cost efficiency has been achieved after the model implementation.

7.3.Discussion on survey findings

The objective of the survey is to evaluate the sustainability of the e-government services from the adoption perspectives. Most of the participants of the survey have not used e-government services offered by the government in Nepal prior to the implementation of the sustainability-driven e-government model. It is found that the participants do not have access to the relevant technology required to use the services, meanwhile they lack the trust and awareness about the offered services. The participants found that the quality of the e-government services in Nepal is very poor as the services are not reliable, and the security provisions are not adequate. The government portals are often come under threat of hacking. There is no proper help and support provided in relation to the use of the portal, while some participants found that the language is not clear. After the implementation of the model, it is noted that the adoption of the e-government services has been significantly increased.

The service delivery channels, mainly rural municipalities, and incorporation of the e-sewa for payment processing have significantly contributed in the user adoption of the e-government services. Most of the participants agreed that the service delivery channels have enabled them to use the services as they don't personally own or have access to the information communication technology tools, i.e. computer and internet. Most of the survey participants found that the government effort to increase trust and awareness among them by conducting seminar, workshops and training have

encouraged them to use the e-government services. However, some of the participants thought that government still needs to put more effort before they can use the services.

In summary, the overall survey findings have supported the research arguments that the adoption of the e-government services depends on the accessibility, trust, awareness and quality of the services.

7.4. Discussion on the expert opinion findings

The purpose of the expert opinion is to generalise the usefulness and adoptability of the model. Most of the participants have agreed that the proposed e-government assimilation model provides an efficient approach for e-government implementation in developing countries. The study has identified the government concern in relation to the adoption of the cloud-based e-government and made appropriate recommendation to address those concern. The study found that the model could be adopted with some minor changes. Those have been recorded and used to customize the model. The participants were agreed that one of the challenges that the e-government project in the developing countries are facing is lack of delivery channels. The study provided an opportunity to verify whether the proposed channels of service delivery would be able to increase the adoptability of the e-government services. Furthermore, the findings show that the main concern in relation to the cloud-based e-government for the government official is the security of the data and availability of the cloud services provider. From the study we have concluded that the cloud based G2G approach would support the governments in the developing countries to better align the e-government projects according to their requirements.

7.5. Validation of the determinants

This section provides a brief discussion on how the findings validate the determinants of the sustainability-driven e-government model. Each stage of the validation has set number of objectives those were directly related to the determinants of the sustainable e-government services. The discussion in this section will be focused on how the objectives/determinants of the sustainable e-government services have been achieved in each stage.

Determinant 1: Detailed assimilation process

This research argues that the detailed assimilation process will contribute in designing suitable e-government services thus needs to be incorporated in the maturity model. The proposed model therefore, included detailed assimilation process to guide government through the stages and activities required to implement sustainable e-government services. The case-study results showed that the stages of e-government implementation and their respective processes defined by the new maturity model are clear and structured that supports the government official to assimilate the project in efficient and effective manner. Government officials found that the detailed activities provided by the proposed model saved them significant time, which was required when assessing and implementing certain services. The predefined set of activities allows government to better prepare for developing strategies to implement e-government services. Besides, significant time saving, government officials also found that the predefined set of activities have saved significant cost and effort. Therefore, this proved that the inclusion of detailed assimilation processes in the maturity model supported the design of sustainable e-government services.

Determinant 2: Streamlined services

The researcher had argued that streamlining e-government systems would support for sustainable e-government service delivery. One of the critical problems found in existing e-government maturity models is the arrangement of the maturity stages. The literature review findings show that the increasing numbers of e-government projects in the developing countries are failing because of the government to citizen (G2C) approach which emphasis on the transaction service should be established before the government service integration. The proposed model Therefore, defined that the integration of e-government systems should be done prior to the transaction stage, to provide streamlined services to users in developing countries. The findings of the case study showed that the integration of the district and local offices contributed to providing seamless and streamlined services to users. This saved the government services delivery time while the government is able to gain increased satisfaction from the users. Particularly, the integration of government systems eliminated the manual paper-based validation processes that was in practice in government offices prior to the model implementation. The model has supported the smooth integration of the isolated e-government system those were held in the different government departments. The database has been interconnected to form a centralized database that could be accessed

by the driving licensing department in different zone of the country. The integration has increased the speed of driving license application authentication process by 70 percent. This could be further reduced by another 20 percent of the other government departments i.e. police and Health services, those also have stake in decision making on driving license application. Furthermore, it has minimized the probability of obtaining license by using fraudulent detail. The driving record could be accessed by the government official regardless of the geographical location that allows them to assess the application more effectively and reduce the chances of error. Case study results shows that the integration of the different system in the different location can be achieved with minimal effort reducing the burden of maintaining the complex and costly wide area network (WAN). We have integrated the legacy system used by the driving license office of Seti Zone to the Bagmati Zone. Both system performed well and acted as a single system that minimized the burden of procuring individual ICT equipment and building ICT infrastructure in each office. The official at the regional government office in the Seti zone were able to process the driving license application without having manually contacting the head office for validating the history of the applicant. This allows government official to make immediate decision in application. This has saved the stakeholder's time and the government officials were able to process three times more application than before. Therefore, new arrangement of the implementation stage proved that the government could deliver streamlined services by adopting the new model.

Determinant 3: State-of-the-art technology

The proposed model emphasises on the use state-of-the-art technology, in this context cloud computing-based e-government for sustainability. As the traditional technologies are becoming rigid, and difficult to sustain from cost and complexity perspective, the researcher argued that the infrastructure as a platform and integration platform as a service could address the problem of inadequate e-government infrastructure in the developing countries. The case study results show that the cloud computing platform has been successfully adopted to implement and integrate the e-government services. The adoption of the cloud computing platform to integrate thee-government services has resulted in the efficiency. Beside this the cloud computing adoption has solved number of technological problem faced by the Nepal government. *Firstly*, the department is expanding following the political reform and requires establishment of the more

information communication technology infrastructure to host and implement new systems. *Secondly*, it was struggling with the power shortage required to run the huge information technology infrastructure, i.e. data centres. The power shortage had resulted in the unreliable services. *Finally*, the legacy systems and physical infrastructure had been failing to handle demand of the user in the pick time. These problems have been successfully addressed by adopting cloud computing platform. The technical performance analysis shows that after implementing the model, the uptime of the e-government service is 90 to 95%. Initially, the server crashed once, however and the technical team has investigated and fixed the issues. The service level agreement with the cloud service provider has ensured that both government and CSP are responsible for ensuring security and managing overall business continuity. From the interview and brainstorming session, the researcher observed that the government officials have some concern on the cloud service provider. The government procurement process is complex that requires to go through certain criteria. A limited number of cloud service providers makes it difficult for the government to select the best possible deal from cost and technology perspectives. Moreover, the government officials are not interested to procure the cloud services from the offshore companies because of the government data security and privacy policy. Therefore, in the long run it is advisable for government to establish their own private cloud infrastructure that could be shared among the government departments.

Determinant 4: Agile accessibility

The determinant agile accessibility argues that to acquire wider acceptance from the user government needs to establish different service delivery channels. Easy access to the e-government service has positive impact on the user decision to adopt the e-government services. Variation in patterns of the use of e-government services showed that more users adopted e-government services after the new model was implemented. Therefore, it is imperative for the government in the developing countries to establish different e-government service delivery channels. The positive relationship between agile accessibility and user decision to adopt the e-government service has also been proved from the findings of the regression analysis. Since the decision to adopt e-government services deals with human behavior, the adoption determinant agile accessibility has been considered as an independent variable and adoption decision as a dependent variable. The regression analysis retrieved a predictive value for agile

accessibility is less than 0.15, which was significant. Thus, this proved that agile accessibility to e-government services acquired wider adoption by users.

Determinant 5: Trust and awareness

Trust and awareness have been defined as the determinants of the sustainable e-government services and incorporated within the adoption stages of the proposed model. The survey findings have firmly supported that the trust and awareness have positive impact on the user decision on the e-government service adoption. The awareness and trust activities defined by the proposed model have significantly contributed in the wider adoption of the services offered by the licensing department. Regression analysis also showed that trust and awareness played crucial roles in the decisions of users to adopt e-government services. The p-values for both trust and awareness were lower than 0.15, which was considered significant. The subjective questions also showed that the government's efforts to build trust and awareness helped the users to adopt and use e-government services with confidence. Therefore, this proved that trust and awareness contributed positively in users' decisions to adopt e-government services.

A new determinant (quality of services) emerged as an important factor that impacts on the decision to adopt e-government services. Most of the participants expressed their opinions in relation to the quality of the offered services, i.e. the online portal and the content of the portal as being less informative and useful. They provided feedback to the government in relation to the improvement in quality of e-government services. Therefore, we included the quality of services as the sixth determinant of the design of sustainable e-government services, which is presented in Figure 7.

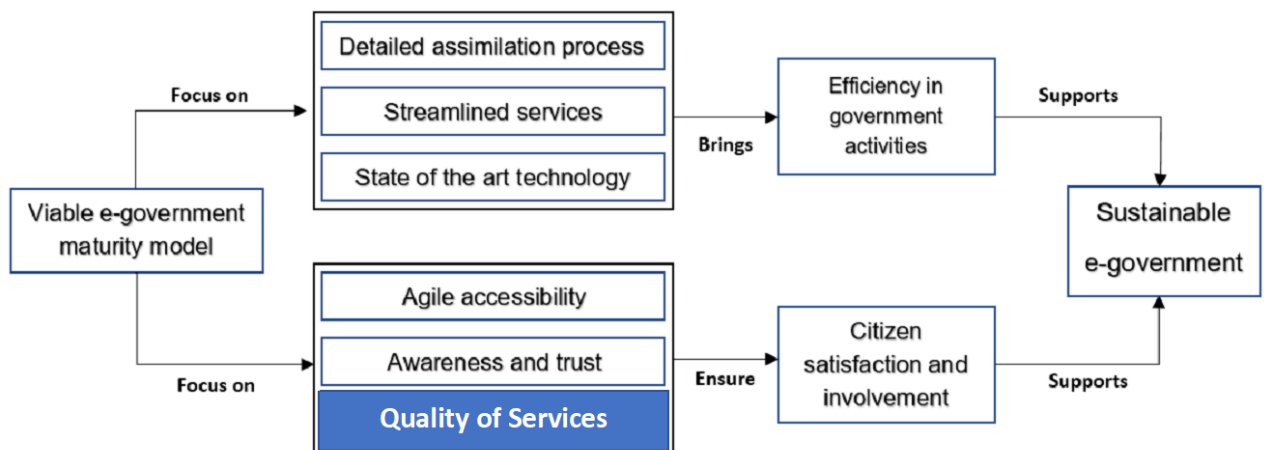


Figure 7.1: Revised determinants of the sustainable e-government service design

7.6.Summary

The chapter presents a brief discussion on the key research findings. The research findings have been analysed in the context of the research aim, objective and questions. The findings show that the research aim, and objectives have been met. The findings have been discussed from the sustainability perspective which involves evaluation of the implementation and adoption determinants. The incorporation of the sustainable e-government services determinants in the proposed maturity model has resulted in the streamlined e-government services, efficiency in the government process while gained wider participation from the users in the e-government services. Based on the discussion and findings, a new determinants quality of service has been identified as an adoption determinant.

This chapter presents the Summary of the research by interpreting the findings and discussion provided in the previous chapter. In general, this chapter provide synthesis of the research findings that interprets the contribution of this research in the subject domain. The novelty of the research, research limitations and the recommendation for the future work are also discussed in this chapter.

8.1. Research Outline

E-government has become unavoidable phenomenon for the governments in the developing countries. Fascinated by the benefits that the e-government delivers, the developing countries have been trying to implement the e-government projects. However, the e-government projects in the developing countries are suffering from the various problems those impacts on the sustainable e-government services. Shrinking budget, availability of the modern technology, digital divide among the people and the skilled human resource are some of the key challenges faced by the developing countries. Besides, the overall design of the e-government which is driven by the e-government maturity model also plays crucial role in the failure of the e-government projects in the developing countries. However, e-government maturity models have been given less importance by the research community. The study found that the models have significant stakes in sustainability of the e-government services. The new evidences have been surfaced after the preliminary investigation has been done in relation to the impact of e-government maturity model in the sustainability of the e-government services. Most of the models have been designed a decade ago and they are based on the technology and organisation scenario of that time. Almost all of models emphasise on the government to citizen (G2C) approach of the e-government implementation that focus on the delivery of the e-government services to the users. However, the existing models failed to address how the offered e-government services will be adopted assimilated among the communities and citizens. Majority of the existing e-government frameworks and models have been designed from the technological perspectives where the adoption side has been given little attention. This gap in the design has contributed in the low adoption rate of the e-government services and as a result there is always a poor sustainability of e-government services. Hence, it is imperative to design a sustainable e-government model that supports the government in the developing countries to deliver effective and efficient e-government services. Therefore, we have proposed a sustainability-driven e-government model that encompasses both implementation and adoption perspectives of the e-government to align the technology with the user's need. The proposed model has been validated for its relevance and usability by using two case-studies. Furthermore, the adoption perspective presented by the model has been validated by using survey and finally expert opinion generalised the findings.

The organisation and conduct of the research has been influenced by the four-stage

method of conducting research defined by Phillips and Pugh (2002), thus the research is also carried out in four-stages.

Stage 1: Background theory

Background theory deals with question like “what and “why. The theory seeks explain what is being carried out and why it’s being carried. The theory discusses the present state-of-the-art in the subject domain and presents the gap in the knowledge. Not only the knowledge gaps but the theory presents the proposed solution to fill the identified gap. Phillips and Pugh (2002) said merely presenting encyclopaedic listing of the literature title without reasoning is inadequate to conduct a research. Therefore, the researcher should demonstrate that one has deep understanding of the subject domain and able to critically analyse the exiting literature. The thesis covers background theory in chapter 1 and 2. Chapter 1 present the introduction of the research, a brief background and the problem domain. The problem domain justifies the need for the research. The chapter further present the significant of the research by providing a brief discussion on the contributing that the research would provide in the domain knowledge. The chapter provides aim and objective of the research and the research questions. A brief introduction of the research methodology used for data collection and analysis along with the research outline has also been included in the chapter 1.

Chapter 2 contains an analysis of the existing literature in the subject domain. It seeks to identify the critical factor affecting the sustainability of the e-government services. We concentrated our focus on both implementation and adoption side of the e-government, thus analysed literature from both perspectives. We reviewed different e-government implementation approach adopted by the different government for their strength and weakness. The impact of digital divide in the sustainability-driven e-government has also been reviewed. We focused our attention to the e-government maturity model which is less discussed from sustainability-driven e-government service design perspective.

Stage 2: Focal theory

The focal theory presents the proposed solution for the knowledge gap identified in the background theory. The research ideas should be precisely presented in the focal theory. The researcher seeks to answer “how” question in the focal theory. The focal theory

presents the researcher's work and contribution in the domain knowledge. Chapter 3 and 4 present the focal theory. Chapter 3 present the background of the sustainability-driven e-government maturity model, its determinants and an overview of sustainability-driven e-government maturity model.

Chapter 4 present the sustainability-driven e-government maturity model. It presents the concept and activities required for the sustainability-driven e-government maturity model. The chapter provides detail on how the model could be used to deliver sustainable e-government services. All activities are precisely discussed along with methods to perform task within the activities. The model accommodated five different determinants from implementation and adoption perspectives. These determinants ensure that the governments get optimum use of resources while delivering services.

Stage 3: Data theory

According to the Phillips and Pugh (2002) data theory deals with the research data. It comprises with the research methods and methodologies for the data collection and analysis. Furthermore, the data theory provides justification for the validity and relevance of the collected data and the reliability of the data sources. The chapter 5, 6, and 7 use the data theory. Chapter 5 presents research methodology and design. Different research methodologies have been discussed for the potential use in the research and final selection. Chapter 6 presents findings from the empirical investigation. Chapter 7 presents the discussion on the findings and provide research synthesis.

Stage 4: Contribution

The contribution part of the thesis presents the conclusion that has been drawn after analysing the researching findings and discussion. It describes the significant of the research and provides rational how the research findings are different from the previous research (Phillips and Pugh 2002). Furthermore, as all the research bares some limitations, the contribution part should be able to point out those limitations and provides directions for the future work. The chapter provides a summary of research while distinguishing itself from the previous research. It outlines the significant and contribution of the research and provide how the research add new knowledge in the subject domain. The chapter also provide a Summary on how research aim, and

objectives have been met. Finally, the chapter provides the limitations of the research and recommendation for the future work.

8.2.Responding research questions, aim and objectives

To accomplish the research, aim and objectives we had formulated four research question as discussed in the chapter 1. Therefore, the conclusion of the research could be summarised by answering the research questions.

The researcher attempted to answer the research question 1 (R.Q.1) by conducting a rigorous literature review in the subject domain. Our literature review has presented different dimensions of the e-government implementation and their impact on the success and failure of the e-government. In general, inadequate technology, lack of budget, lack of skilled human resources, availability, access to the technology for the citizen and digital divide are some of the widely discussed issues in e-government in the developing countries. Beside these issues, we have presented design related issues those influence the success of e-government. We found that the e-government maturity model and e-government implementation approach are particularly troublesome. We have also highlighted the attempts made in the recent year to address these issues and the future requirement of the research in the domain. Thus, R.Q. 1 has been addressed by identifying different issues those impact the sustainability of the e-government services.

Research question 2 (R.Q.2) has been addressed by identifying the impact and role of the e-government maturity model. Despite some of the previous research has pointed out that e-government maturity models are failing to align with the maturity level of the e-government projects in the developing, no research has attempted to thoroughly investigated whether the maturity model have any role in design of the sustainable e-government services. Therefore, we have formulated a research question that attempt to find how and why e-government maturity model impact on the overall success of the e-government projects in the developing countries. We found that many of the developing countries have adopted these maturity models who are failing to make significant progress. After investigating the literature in maturity model and the e-government projects in the developing countries we found that most of the developing countries have adopted government to citizen approach of e-government implementation as suggested by almost all the maturity model. The maturity models say government must initiate transaction services (G2C) before the integration (G2G) is done. This is the most

problematic issue in the maturity model. Users in the developing countries have less access to the information communication technology; as such they are less likely to get benefited from the G2C approach. Furthermore, without integration of the government services, some of the government services require second validation or could not be obtained in real time. Therefore, even the government offer e-government services users are reluctant to use them, making the services unsustainable. Therefore, the existing e-government maturity models highly contributed to make the e-government projects less sustainable in the developing countries.

The research question 3 (R.Q.3) has been addressed by identifying the determinants for the sustainable e-government services. The limitations in the exiting e-government maturity model have motivated to define the determinants for the sustainable e-government services. We categorised the determinants as implementation and adoption and used them to design the sustainability-driven e-government maturity model.

The research question 4(R.Q.4) has been addressed by underlining the requirements of the streamlined services. The government to government approach has been discussed by this research which justifies the G2G approach of e-government implementation to streamline e-government services. The approach has been identifying as one of the concept of the sustainability-driven e-government model. The approach emphasises on integration of the government departments before enabling government to citizen services. The integration would allow government to avoid data replication and data silos, while reducing the overall e-government project cost.

We have addressed research question 5 (R.Q. 5) by proposing a suitability-driven e-government maturity from the perspective of the developing countries. We have precisely stated the requirement for the sustainable e-government services, the determinants of the sustainability-driven e-government maturity model, its stages and activities in detail. The model has been developed by investigating the limitations in the existing e-government maturity model. The limitations than have been addressed by introducing different determinants those are than included in the new maturity model. We have considered both implementation and adoption perspectives of the e-government while designing the maturity model to balance the demand and supply of the e-government services. Finally, the proposed model has been validated for its applicability and usefulness in the context of the developing countries. The findings show that the proposed model can support the governments in designing and delivering

the sustainable e-government services.

8.3. Research contribution

The research has significantly contributed by providing solution to design and deliver sustainable e-government services in the context of developing countries. The research provided insight in the domain knowledge by identifying the role of the e-government maturity model in the success and failure of the e-government projects and by proposing a new maturity model from the sustainability perspective. The practical implication of the proposed model in the real world is even more significant as the proposed model has been validated in the context of Nepal that enables other developing countries to adopt the model to attain sustainable e-government services. The significance of the research could be summarised in the following points.

Contribution 1: This research contributes in the domain knowledge by investigating the issues that impact on sustainable e-government services. The research identified that the existing e-government maturity model lacks the e-government services adoption perspective and the arrangement of the maturity stages has failed to support the government to design sustainable e-government services. The research indicates that the both implementation and adoption aspect of the e-government services has significant relation on the sustainability of the e-government services. Therefore, the research made contribution by identifying 5 determinants, i.e. detailed assimilation process, use of state-of-the-art technology, streamlined services, agile accessibility and trust and awareness, those needs to be included in the e-government maturity model to address the limitations of the existing e-government maturity model.

Contribution 2: The research contributes by proposing a sustainability-driven e-government maturity model (SDEGM) that supports to design and delivery of the sustainable e-government services for the developing countries. The sustainability-driven e-government maturity model (SDEGM) incorporates both e-government implementation and adoption stages, which explain what approach the government should take when delivering its services to gain maximum use involvements.

Contribution 3: The research identifies that the integration of the e-government services is imperative to deliver streamlined e-government services. Therefore, the integration should be done before the transaction stage of the e-government assimilation. This fact has been denied before, as all the existing e-government maturity

model argued that the transaction occurs before the integration. The proposed model contributed by validating this argument that the integration must be done to gain better user involvement and achieve efficiency in the e-government projects.

Contribution 4: The proposed model has been evaluated by using two different case-study in the context of Nepal and the findings have justified the implication and usefulness of the proposed model in designing sustainable e-government services for the developing countries.

Contribution 5: The research has contributed by proposing cloud computing platform for the integration and implementation of the e-movement services in the context of the developing countries. As developing countries have been struggling to establish the adequate information communication technology infrastructure for implementing e-government services, the proposed cloud computing-based e-government service implementation approach would bring support to achieve this objective.

8.4. Research limitations and Recommendations

Although the research has achieved its aim and objectives, the researcher has highlighted some of the research limitations in this section. The evaluation part focuses on single geographical location which could impact its generalisation. Therefore, more case studies from different context are necessary to generalise our finding. Another limitation is sample size. Despite the efforts have been made to include participants from the different social background, relatively bigger sample size from the different geographical and participants from different background would have provided more generalise findings. Finally, a detailed checklist for cloud-based e-government implementation process can support the key government stakeholder and simplified its implementation activities.

As e-government is continuously evolving along with the technological advancement there is always a need of further investigation to explore the topic. E-government is wide domain to investigate and it is not possible for a single research to address and investigate all the aspects of the e-government. This research has particularly focused on the sustainability of the e-government services from its design perspectives. Within sustainability, we have focused our attention on the impact of the e-government maturity models in sustainability and conducted the research accordingly. The research

has significantly contributed in designing the suitability-driven e-government maturity model. As researches suffer from some limitations we have made recommendation for the future work.

Recommendation 1: The proposed model has been evaluated by using case studies from the perspectives of Nepal. Further study is recommended to evaluate the applicability of the proposed model in the different country context.

Recommendation 2: The adoption perspectives of the sustainability-driven e-government model has been assessed by using survey method. The survey size was relatively small and limited to the university student and local resident of a small geographical area. Therefore, to better represent the population size and the people with the different socio-economic, education and cultural background another survey is recommended that accommodate the above-mentioned concern.

Recommendation 3: The model lacks practical detail on the cloud-based e-government integration and implementation, further study is recommended to investigate the cloud computing applicability for the e-government in the various context.

Recommendation 4: Further study is recommended to evaluate the effectiveness of the model, especially to assess the effectiveness of the accessibility channels and transaction processing model proposed by the model for their contributing in achieving wider participation from the users in the e-government activities.

8.5.Further work

To generalize the use of any model or frameworks it needs to be tested in the different context. To further validate the usefulness of SDEGM in developing sustainable e-government services, we are working on some more case study in the different country context. A paper "Evaluation of the Implication of Sustainability-Driven E-Government Maturity Model from the Perspective of Developing Countries" is under review by a journal. Along with this paper we are also working on the security framework for cloud-based e-government that will support SDEGM user in provisioning a security measures when adopting third-party cloud infrastructure for e-government implementation.

8.6.Summary

The study identified different problems which has contributed in the failure of the e-government projects in the developing countries. The researcher carefully considered the efforts made so far to address the problem and critically review them for their limitations and implications. The researcher made an argument that the efforts are not sufficient and proposed a sustainability-driven e-government maturity model (SDEGM) that fills the knowledge gap in relation to the design and delivery of sustainable e-government services.

The researcher has employed two different case studies along with the expert opinion and survey to implement and validate the proposed model. The model has been amended and revised as deemed appropriate after its implementation. The findings and the analysis of the data has made it clear that exiting e-government maturity models could not support the governments in the developing countries to delivery sustainable e-government services. It is evident from the findings acquired from the various methodologies applied to validate the proposed model, the sustainability-driven e-government maturity model (SDEGM) can support the design and implementation of the sustainable e-government services in the context of the developing countries. The validated model thus could be adopted by the governments in the developing countries to design sustainable e-government services. Therefore, the novelty of the research in designing sustainability-driven e-government model to support the governments to make its services more directed towards to the needs of the citizen could be justified as a significant contribution of this research.

Finally, the researcher indicates the limitations of the study and provides the recommendation for the future work which will encourage the other researcher to investigate and research the subject domain to generate new ideas and fill the gap that is identified in the form of limitation of this research.

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Appendices

Appendix A: Documents collected for the Case-study

Document Name	Description
Draft of e-Governance Master Plan Nepal	<p>This document was produced initially in 2007 and later an updated draft has been presented to the government of Nepal in July 2014.</p> <p>This document provides a complete detail of the e-government initiative of Nepal, the model it has adopted, its vision, goal and objectives. It defines how government will move forward to implement e-government services.</p>
National Plan for e-Governance in Nepal	<p>This is a comprehensive presentation which is presented by one of the member of High Level Commission for IT Nepal which is prepared to highlight the current state of the e-government in Nepal and future goals.</p>
Nepal Government Enterprise Architecture	<p>This document provides an overall technological approach that the Nepal government has adopted to design and implement the e-government services.</p> <p>This includes;</p> <ul style="list-style-type: none"> - Shared e-government infrastructure - Data centers design and architecture - Statewide area network development plan - State data center design and architecture - Infrastructure governance <p>In sort this provides a comprehensive plan for establishing appropriate technological standard required for the e-government services.</p>
ICT Policy-2072 Nepal	<p>This document provides a summary of the government ICT policy. It discusses, the government initiative in relation to designing and developing government policies in relation to the use of information communication technology in governance.</p>
Electronic Transactions Rules-2064 Nepal	<p>The documents provide the government laws, acts and rules developed for electronic transaction processing in Nepal.</p>
Government Websites Design/Development and Management Guidelines-2068 Nepal	<p>The document provides guidelines and standard for the government department and ministries while designing and developing their website.</p>
NeGIF Main Report v2.0	<p>This document provides a detailed discussion on the data standard and architectural standard to maintain interoperability among the different e-government services.</p>

Appendix B: Open ended interview questions during case-study

These questions have been asked during the different stages of the case study to record the key findings at each stage. The unstructured interview approach had been used.

Stage 1: Interview questions for government employee

1. What is the problems you have been facing while implementing e-government services?
2. What is the ratio of the citizen involvement in the e-government activities?
3. What are government objectives for implementing e-government services?
4. What is impact of the proposed model in designing the e-government implementation process?
5. Do you find the delivery channels and electronic transaction methods proposed by the model useful to deliver e-government service?

Stage 2: Interview questions for government employee and other members involved in the project.

1. Did the e-government implementation approach has contributed in streamlining e-government service?
2. What are the issues the government is facing while adopting cloud commuting platform to streamline e-government services?
3. What are legal and policy level issues government is facing to adopt cloud computing?
4. What are the government security concern in relation to the use of cloud computing platform?
5. Does government have enough resources to adopt private cloud?

Stage 4: Interview questions for government employee and other members involved in the project.

1. Did you achieve efficiency in the government service delivery process after implementing the proposed model?
2. What impact the proposed model has in citizen adoption decision?
3. What are the cost implications on the government to adopt the proposed approach of the e-government implementation?
4. Has the government achieved its technical requirements?
5. Do you think the security and privacy of the government data and information has been appropriately ensured?
6. How confident do you feel in relation to the security of the data and information held in the cloud computing platform?
7. What steps could be taken to improve the proposed approach?

Appendix C: Survey questionnaire

Cover-sheet

Dear participant,

I would like to thank you for your participation in this survey.

The aim of this research is to develop sustainability-driven e-government model that supports developing countries to design and implement sustainable e-government services. The researcher aims to evaluate, the effectiveness of the proposed e-government service delivery channels, e-transaction model and user involvement in the e-government activities from this survey.

To maintain the anonymity and confidentially, we would not ask you to provide any of your personal information. Once the answers are recorded, all the written paper and information will be safely shredded. The answers of this survey are strictly used for this research purpose. You are not obliged to answer the questions that you do not wish to answer. However, the researcher would appreciate if you could complete the survey.

Thank you for your time and co-operation.

Kind regards

.....

Instrument 1: Demographic information

S.N.	Question	yes	No
1	Do you own a computer?		
2	Do you have access to the internet?		
3	Have you ever used the e-government services?		
4	Do you own smart phone?		

Instrument 2: Subjective questions (Note: Please provide your own view)

1. How often and what e-government services do you generally use?

.....

2. What are your available channel to access e-government services?

- mobile,
- own computer,
- cyber café,
- library,
- other.....

3. Are you satisfied with the newly deployed e-government services?

Yes / No / Not sure

4. What does the government need to do, to make e-government services accessible and reliable?

.....

5. How do you describe the quality of the e-government services prior and after the implementation of the sustainability-driven e-government model?

.....

6. What are the problems you have faced while using the e-government services prior the implementation of sustainability-driven e-government model?

.....

Instrument 3: Objective Questions

Construct 1: Accessibility to the e-government services

Note: Please Tick the most suitable number to your opinion. The number represent the scale of your opinion.

1= strongly disagree, 2= disagree, 3= Natural, 4= agree, 5= strongly agree

Q.N	Questions	Scale				
		1	2	3	4	5
Agile accessibility to the service						
1	E-government services are easily accessible to me and the people live around me.					
2	The current effort put by the government for e-government services delivery is sufficient.					
3	The proposed e-government services delivery channels are useful and would enable me to access the services conveniently.					
4	I prefer to go to the government office because getting e-government services takes much effort.					
5	I will use the e-government services if they are easily accessible.					

Construct 2: Trust and awareness

Note: Please Tick the most suitable number to your opinion. The number represent the scale of your opinion.

1= strongly disagree, 2= disagree, 3= Natural, 4= agree, 5= strongly agree

S.N	Questions	Scale				
		1	2	3	4	5
Trust on the e-government services						
1	I have trust on the e-government services offered by the government					
2	The e-government services offered by the government are reliable.					
3	I prefer using government services manually than online because I think the online services are not secure.					
4	I don't think trust on the e-government services has influence my decision to adopt the e-government services					
5	If the government guarantee the security and privacy of the online transactions I will use the e-government services.					

Awareness on the e-government services						
1	I am aware of the e-government services offered by the government					
2	The workshop, seminar and training offered by the government to enhance the skills are helpful in adopting e-government services					
3	If the e-government services are reliable, trustworthy and beneficial, I will use them in future.					
4	Awareness on the e-government services has changed my decision on adoption of the services					
5	The government efforts to develop awareness in our community are sufficient					
6	If the government provide appropriate training and support I would prefer using e-government service in future					

Appendix D: interview questions for expert opinion

Introduction

Dear participants,

Many Thanks for taking your time to participate in this research. The objective of this study is to get an opinion on the usefulness and impact of the proposed sustainability-driven e-government maturity model (SDEGM) in designing sustainable e-government services in the developing countries.

I strongly believe that your knowledge and expertise in the subject domain will provide a measure to evaluate the proposed model.

Kind regards.

Questions

Note: Please provide your answers in brief, any example and previous experiences are appreciated while justifying your opinion.

Construct 1: Detailed assimilation process

1. Why do you think detailed assimilation process is necessary for government while adopting an e-government maturity model for implementing e-government project?
2. Do you think the process and activities provided by the sustainability-driven e-government model will be able support the government smooth e-government implementation?
3. Does detailed assimilation process have any impact on designing and delivering sustainable e-government services?

Construct 2: Streamlined services for efficiency in government process

1. How does streamlining e-government services will bring efficiency in the government process?
2. How does the e-government approach adopted by the sustainability-driven e-government model would contribute in streamlining e-government service in developing countries?
3. What are benefits of streamlined e-government services?
4. What are techniques available to streamline e-government services in the developing countries?
5. Is the technological approach defined by the sustainability-driven e-government maturity model (SDEGM) viable for implementing and streamlining e-government services in developing countries?
6. How does streamlined e-government services would contribute in citizen satisfaction?

Construct 3: Use of state of the art technology for e-government implementation and integration

1. Do you think the use of state-of-the-art technology in government process to implement and integrate services is viable option for developing countries?
2. How does the use of social media, and other platform to make government presence among the user would contribute in trust and awareness?
3. Do you think the use of state-of-the-art technology would increase the sustainability of the e-government project in the developing countries?

Appendix E: Customized information assurance framework

Organisational risks				
Supply-chain Failure	Available Measures			
Do you audit your outsourcers and subcontractors and how often?	Yes	No	Week/Month	
Are any SLA provisions guaranteed by outsourcers lower than the SLAs you offer to your customers?	Yes	No		
What measures are taken to ensure third party service levels are met and maintained?	Explain in brief			
Can the cloud provider confirm that security policy and controls are applied (contractually) to their third-party providers?	Yes	No		
Service termination				
What is the service termination notice period?	week	month	6 months	1 year
What happens to the data sent to the cloud provider upon termination of the contract?	Explain in brief			
Lock-in				
Are there documented procedures and APIs for exporting data from the cloud?	Yes		No (Explain)	
Does the vendor provide interoperable export formats for all data stored within the cloud?	Yes		No (Explain)	
Can the client perform their own data extraction to verify that the format is universal and is capable of being migrated to another cloud provider?	Yes		No (Explain)	
Technological Risks				
Security and privacy	Available measures			
Can the provider detail what information is recorded within audit logs?	Yes		No	
Is it possible to segment data within audit logs so they can be made available to the end customer and/or law enforcement without compromising other customers and still be admissible in court?	Yes		No	
What controls are employed to protect logs from unauthorised access or tampering?	Explain			
What method is used to check and protect the integrity of audit logs?	Explain			
Isolation failure	Available measures			
What levels of isolation are used?				
Does the provider carry out penetration testing? How often?	Yes (Times...)		No	
Is the virtual network infrastructure used by cloud secured to vendor and/or best practice specific standards?				
Does the provider ensure virtual images are hardened by default?				
Availability	Available measures			
Does the provider offer guarantees on the availability of supplementary resources within a minimum period?	Yes		No	
Does the provided offer guarantees on the server availability and service uptime?	Yes		No	

Legal risks		
<i>Data protection</i>	Available measures	
What assurance can you provide to the customer regarding the physical security of the location?	Explain in brief.	
Who, other than authorised IT personnel, has unescorted (physical) access to IT infrastructure?	Example (Cleaner, security staff, consultant, technician)	
How often are access rights reviewed?	Provide the time frame.	
Do you control or monitor personnel (including third parties) who access secure areas?	Yes	No
What measures are in place to control access cards?	Explain in brief.	
What processes or procedures are in place to destroy old media or systems when required to do so?	Data overwrite/physical media destruction	
How often are checks made to ensure that the environment complies with the appropriate legal and regulatory requirements?	Please provide the time frame.	
<i>Unspecified Risks</i>		
What methods do you use to prevent physical damage of the infrastructure from a fire, flood, earthquake, etc?	Explain in brief	
Is the cloud provider's infrastructure located in the same country or in different countries?	Please name the country.	
Will jurisdiction over the contract terms and over the data be divided?	Yes	No
Will any of the cloud provider's services be subcontracted out or outsourced?	Yes	No

Appendix F: Technological performance evaluation checklist

parameters	Check lists	outcome
Load Handling		
	Response time on the service request at normal time	
	Response time on the service request at peak time	
Uptime		
	Percentage of uptime for a service in a given observation period	
	Elapsed time from when a service is invoked to when it is completed (typically measured in milliseconds)	
Scalability		
	Automated scalability	
	Service allocation time for the quick service deployment	
Stress handling		
	Maximum number of concurrent service request	
	Stress handling while the number of user exceed the limit	

Appendix G: E-government service prioritisation template

[illegible]